Research Note 81-29

GUIDEBOOK FOR USERS OF TRAINVICE II

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U. S. Army

Research Institute for the Behavioral and Social Sciences

December 1981

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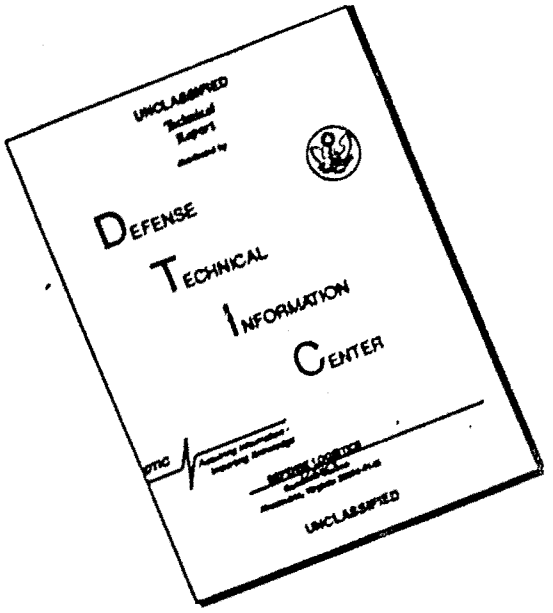

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Research Note 81-29
2. GOVT ACCESSION NO.: AD A126 197
3. RECIPIENT'S CATALOG NUMBER:

4. TITLE (and Subtitle): GUIDEBOOK FOR USERS OF TRAINVICE II
5. TYPE OF REPORT & PERIOD COVERED:
6. PERFORMING ORG. REPORT NUMBER: SAI-80-065

7. AUTHOR(s): Robert W. Swezey, Robert A. Evans
8. CONTRACT OR GRANT NUMBER(s): MDA 903-79-C-0428

9. PERFORMING ORGANIZATION NAME AND ADDRESS: Science Applications, Inc., 1710 Goodridge Drive, McLean, Virginia 22102
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 2Q1623743A771

11. CONTROLLING OFFICE NAME AND ADDRESS: Simulation Systems Technical Area - PERI-IE, US Army Research Institute for the Behavioral and Social Sciences-5001 Eisenhower Ave Alex, VA 22333
12. REPORT DATE: December 1981
13. NUMBER OF PAGES: 227

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office):
15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Monitored Technically by: G. Gary Boycan and Marshall A. Narva

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

TRAINVICE
TRAINVICE II
Transfer of Training Model
Training Device/Simulation Assessment

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This User's Guidebook documents a transfer-of-training model known as TRAINVICE II. Each of the components of TRAINVICE II are documented such that a user can apply the model in training equipment evaluations.

The development of the guidebook was based primarily on ARI Research Memoranda 79-6 and 79-7. Some changes, however, are reflected in the formula reported here.

Potential users of the model are cautioned as to a variety of technical issues which remain unresolved. A more detailed discussion regarding these

Item 20 (continued)

issues can be found in the final report for this project (Research Note: 81-28).

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		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)*		8. CONTRACT OR GRANT NUMBER*(s)*
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)*
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT *(of this Report)*		
17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*		
20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*		

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Office, Deputy Chief of Staff for Personnel
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December 1981

Army Project Number
2Q162743A771

Training and Utilization
in Military Systems

ACKNOWLEDGMENTS

This Guidebook documents a research-version of a transfer-of-training model known as TRAINVICE II. An approach, similar to the one presented here, may ultimately enable a user to determine how well a training device covers and implements specific training requirements. The work presented here represents one step in a series of efforts to develop a training device evaluation methodology. The validity of TRAINVICE II remains to be demonstrated. As such, in its present form, this Guidebook should be considered a research tool.

Several individuals have provided major contributions to this effort. Marshall A, Narva, author of the TRAINVICE II model and original Technical Monitor of this Guidebook development project, provided major guidance to the project staff. Dr. Narva's successor as Technical Monitor, G. Gary Boycan of ARI, also contributed substantially to this effort as did Robert Wanschura. Claude G. Songy of Science Applications, Inc. was a contributer to early drafts of the Guidebook. He further assisted in this project by suggesting several revisions to the original TRAINVICE II Index. It is Mr. Songy's revised Index that is employed in this Guidebook. Dennis G. Faust provided major support by thoroughly reviewing and commenting on earlier versions of the Guidebook manuscript.

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CHAPTER 1

INTRODUCTION

How to Use This Guidebook

TRAINVICE II is an analytic method for assessing training devices and training device concepts. The model enables a user to determine how well a training device covers and implements specific training requirements. TRAINVICE II can be applied either to the assessment of an existing training device or early in a device's development and acquisition cycle. The purpose of this Guidebook is to document the components of TRAINVICE II in a format which enables Army users to apply the model in training equipment acquisition and evaluation activities.

Application of the TRAINVICE II model to existing training devices is termed a "predictive application" of the model and is the subject of this Guidebook. A "prescriptive application" of the model to the formulation of a training device concept or to assess several competing concepts is also possible, and is described in Appendix C for users who might have interest in such an application.

The TRAINVICE II model consists of six separate components. The six components are designed so that a user can apply each one separately, or can combine them into a complete TRAINVICE II anlaysis by computing an index to show the overall potential of a training device or simulator.

In order to aid users in applying TRAINVICE II in total or in part, each of the separate TRAINVICE II components is addressed as a separate Chapter in this Guidebook. To conduct a complete TRAINVICE II analysis, you should read all of the chapters in this Guidebook and follow the procedures described. If however, you are interested only in one or more of the separate components, go directly to the appropriate chapter and follow the procedures for that part of the TRAINVICE II model. Refer to the Table of Contents to find the appropriate component of interest. In either case, it is recommended that you become familiar with all of the TRAINVICE II model before applying its components.

Following are some features of this Guidebook which are intended to simplify its use:

- Pages are numbered within the chapters.
- Chapters have flow charts and figures, as appropriate, to show the sequence of operations required for completing TRAINVICE II components. The flow charts fold out so that you can easily refer to them while reading the text. The flow charts show where the user is in the TRAINVICE II process.
- Major points to remember are enclosed in a box; other important points are identified by bullets to make them stand out.

- Examples are provided for illustration and are titled for easy reference.

BACKGROUND

One effect of reductions in military training budgets is decreased availability of operational equipment for use as trainers. This, plus the fact that using operational equipment in some situations may not produce the best training benefits, or may not be safe to use in training, has led to the increased use of training devices and simulators.

For these and other related reasons, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has devoted a major effort to the development of a model for assessing the effectiveness of training devices. The model is known as TRAINVICE and was originally developed in 1976.[1]

The original TRAINVICE model was designed to provide a method for estimating the effectiveness of training devices. The model made judgements on several variables, combined the judgements into a "figure of merit" or summary index, and assessed transfer of learning from the training device to operational equipment.

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[1] Wheaton, G., Fingerman, P., Rose, A. and Leonard, R. Evaluation of the effectiveness of training devices: Elaboration and application of the predictive model. Research Memorandum 76-16, U.S. Army Research Institute for the Behavioral and Social Sciences, Arlington, VA, July 1976.

In May 1977, ARI convened a Conference for the purpose of reviewing the TRAINVICE model. At the Conference, the model was reviewed and discussed with its developers and suggestions for simplification and revision of the model were made. One of the problems raised at the Conference was that the TRAINVICE model was possibly too complicated and difficult to use in its original form. For this reason, a revision of the original model was undertaken. This revision became known as TRAINVICE II.[2,3]

TRAINVICE II was intended to improve upon the validity and practicality of the original model, and to make the methodology easier to use. The main purpose of TRAINVICE II is to provide a method for assessing training devices or training device concepts in their early design phases, in terms of implementing specified training objectives.

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[2]Narva, M.A. Formative utilization of a model for the prediction of the effectiveness of training devices. Research Memorandum 79-6, U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA, May 1979.

[3]Narva, M.A. Development of a systematic methodology for the application of judgemental data to the assessment of training device concepts. Research Memorandum 79-7, U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA, May 1979.

TRAINVICE II (Narva, 1979), includes the following six components which are combined to derive an index of training device effectiveness:

TRAINVICE II COMPONENTS
1. Coverage requirement analysis
2. Coverage analysis
3. Training proficiency analysis
4. Learning difficulty analysis
5. Physical characteristics analysis
6. Functional characteristics analysis

Through these six components, the TRAINVICE II model provides a systematic way to answer three questions about a training device. The three questions, basically, are:

THREE TRAINVICE QUESTIONS
• What?
• Why?
• How?

The WHAT, WHY, and HOW questions are asked for each unit of behavior to be trained. In order to answer the question "WHAT should be represented in the training device," two related inquiries are made, these are:

- What training activities are required of and must be present in the training device?
- Is that activitity actually covered by the particular device being evaluated?

The "WHY" question deals with a more detailed "defense" of the reason for including the unit of activity in the device. The WHY analysis evaluates proficiency and difficulty aspects of activities to be covered by a device. It makes the two following inquiries:

- Training proficiency--What is the degree of trainee proficiency required at the end of training?
- Learning difficulty--What is the degree of learning difficulty associated with attaining the desired level of proficiency?

The last question, "HOW", is the one that deals with how activities should be taught. The HOW question considers:

- Do the physical characteristics of the device follow recommended guidelines for "good instructional practice"?,
- Do the functional characteristics of the device follow recommended guidelines for "good instructional practice?"

To summarize, TRAINVICE II components ask:

WHAT:
Coverage Requirement Analysis • What training activities must be present in the training device? Coverage Analysis • Are each of these activities actually represented in the device?

WHY:
Training Proficiency Analysis • What level of trainee proficiency is required for the activity? Learning Difficulty Analysis • How difficult will it be to learn the activity?

HOW?
Physical Characteristics Analysis • How well do the physical characteristics of the device meet appropriate instructional requirements and guidelines? Functional Characteristics Analysis • How well do the functional characteristics of the device meet appropriate instructional requirements and guidelines?

In order to apply TRAINVICE II, the user needs several types of preliminary input information. Figure 1.1 (on the foldout page at the end of this Chapter) shows a flow chart of the TRAINVICE II model, including its input requirements. These inputs are:

- The training objective(s) of interest; including the action(s) or task(s) that a student should be capable of performing and the conditions and standards of performance by which those actions should be performed as a result of training.

- Task descriptions for the tasks to be trained, for both the actual operational equipment and the training device.

- Subtask descriptions for both the operational equipment and the training device.

- Descriptions of the skills and knowledges required for task (and subtask) performances for both the operational equipment and the training device.

- Descriptions of the cues and responses required for each skill and/or knowledge within each task (and subtask) for both the operational equipment and the training device.

- A consolidated list of the skills and knowledges required for performance of each task or subtask.

This information will serve as input information to the anlaysis. Specific input requirements are stated in subsequent chapters and in the TRAINVICE II PROCEDURES CHECKLIST, APPENDIX D.

Having outlined the history of TRAINVICE II, the questions of WHAT, WHY, HOW, and the input requirements, we will conclude the introductory overview with a brief description of the TRAINVICE II components. Each of these components is briefly described below. Chapters to follow will fully explain each component to the level of detail necessary for user application.

Coverage Requirements Analysis (CR)

The first analysis conducted in a TRAINVICE II application is called the Coverage Requirements Analysis. This analysis answers questions regarding whether or not training for each skill or knowledge (which comprise the overall training objectives) should be included in a training device. In brief, the CR analysis specifies what training must be covered by a training device.

Coverage Analysis (C)

This TRAINVICE II component addresses the extent to which the skills or knowledges judged to be required are actually included in a particular training device. A comparison is made between the Coverage Requirement Analysis and the Coverage Analysis to determine whether training coverage which is necessary in a device is lacking, or whether training which is unnecessary has been included.

Training Proficiency Analysis (P)

The third component of the TRAINVICE II model involves determining the degree of trainee proficiency required at the end of training, for each of the skills judged to be necessary. A rating scale is employed for this purpose.

Learning Difficulty Analysis (D)

Learning Difficulty Analysis involves assessing the degree of difficulty associated with learning each skill or knowledge. This analysis considers such factors as trainee entry-level skills,

inherent level of difficulty of each activity, required proficiency level, and requires that the learning difficulty of each skill or knowledge be rated on a 4 point scale.

Physical Characteristics Analysis (PC)

The Physical Characteristics component of TRAINVICE II analyzes stimulus capabilities and trainee response modes of the training device, for every display or control used in training each skill and knowledge. This assessment is accomplished by determining how well the physical aspects of a training device support standards for good instructional practice.

Functional Characteristics Analysis (FC)

This final component of the TRAINVICE II model assesses how well the design characteristics of a training device function in the training process. As with the Physical Characteristics Analysis, a judgement is made regarding the extent to which appropriate instructional guidelines are implemented.

Index Computation

All data developed from each of the TRAINVICE II analysis components are combined in an equation. The equation produces an index for each device assessed, in terms of its potential for transfer of training. The index ranges from 0 to 1; higher scores indicating greater transfer of training potential. The index is computed by the following formula:

TRAINVICE II INDEX

$$\text{Index} = \frac{\sum \left(\frac{PC + FC}{PCmax + FCmax} \right) \left(C \times P \times D \right)}{\sum (P \times D)}$$

where:

C = Coverage Score
P = Training Proficiency Score
D = Learning Difficulty Score
PC = Physical Characteristics Score
FC = Functional Characteristics Score
PCmax = Maximum Possible Physical Characteristics Score
FCmax = Maximum Possible Functional Characteristics Score

Chapters to follow will detail each component of the TRAINVICE II analysis. For user reference, a complete procedural checklist with examples is provided as Appendix D. Blank data worksheets forms are included in Appendix E for reproduction by the user.

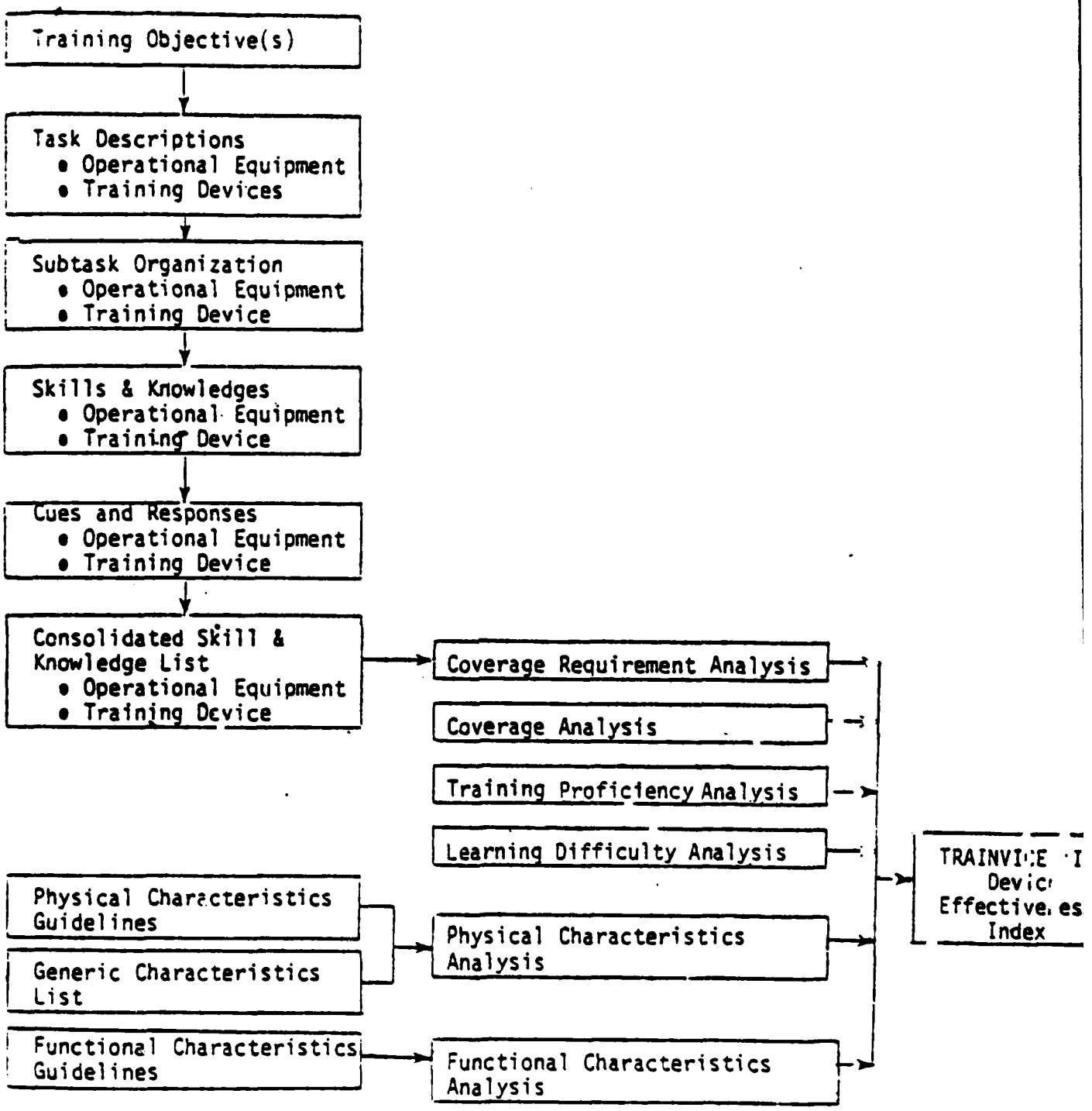

FIGURE 1-1. TRAINVICE II MODEL

CHAPTER 2

COVERAGE REQUIREMENTS ANALYSIS

The first component of the TRAINVICE II model is the Coverage Requirements (CR) Analysis. Coverage Requirements (CR) Analysis determines which skills and knowledges exercised in a real-life operational setting should be required in a training device. Specifically, the analysis requires Yes-No decisions as to whether a particular skill or knowledge is to be represented in a training device. It is important to note that what is required in a device is rarely, if ever, a total replication of the operational setting. What is usually required is a practical way to present the tasks required for doing the real-life job.

Refer to Figure 1-1, the TRAINVICE II flow chart, and locate the Coverage Requirements (CR) Analysis in the overall model scheme. It is important to note the following point:

> Before beginning the Coverage Requirements (CR) Analysis, you must consolidate the skills and knowledges of the job area to be trained, (which are identified through a TASK ANALYSIS) into one master list.

This consolidation is necessary because identical skills and knowledges may be present in more than one task. In TRAINVICE II, however, they need only be represented once.

Coverage Requirements Analysis Procedure

The procedure to follow in conducting the CR Analysis, shown in the Figure 2-1 flow chart, indicates that a Consolidated List of operational skills and knowledges is used as the basic input for the Coverage Requirements (CR) Analysis. The Consolidated List should contain all skills and knowledges believed necessary for training.

Working from the Consolidated List of operational skills and knowledges, the second box in Figure 2-1 indicates that you select a skill or knowledge from the Consolidated List. Next, a decision must be made concerning whether that skill or knowledge should definitely be covered by the training device. This decision process is represented by the diamond shaped box in Figure 2-1.

If you decide the answer is YES, (i.e., the selected skill or knowledge should be covered by the training device), then you record a "1" for that skill or knowledge. If your answer is NO (i.e., the selected skill or knowledge is not necessary), you record a "0" for that skill or knowledge.

REMEMBER:

You will rate each skill and knowledge on the Consolidated List with a "1" or "0" depending on whether the skill or knowledge should be covered by the training device.

"1" = Should be covered by the device

"0" = Not necessary

These simple steps represent a complete CR Analysis cycle for a given skill or knowledge. The next stage in the process is to recycle through each remaining skill and/or knowledge until all have been considered. The last decision, therefore, is simply to determine when you have rated the last skill or knowledge on the Consolidated List.

In completing a CR Analysis, the following point should be clearly understood by the user:

Coverage Requirements (CR) Analysis is concerned only with identifying what skills and knowledges must be covered by the training device.

For the job area of interest, there may be many tasks required of the trainee in the real-life operational setting. Yet, many of these tasks may be identical (or nearly so) for various aspects of actual field operations. For example, six types of "scanning"

tasks might be required of an operator, yet they may be so similar in nature that the technique of scanning need be trained only once. Therefore, a training device need only be concerned with a single skill/knowledge area called "scanning", and not with six non-significant variations on the same skill.

Consider a hypothetical example which further illustrates this point. Assume you have a training situation where you are teaching missile operating procedures to crewmen of an anti-armor missile system. One of the tasks associated with the missile system operating procedures involves acquiring the target. The skills and knowledges required in acquiring a target are:

- Visually select a target
- Discriminate between enemy targets and other targets
- Know the silhouettes of threat vehicles
- Know scanning techniques (visual field and instruments)

In this example, note that some of the skills and knowledges would not be appropriate in training situations where you are concerned primarily with instruction on how to operate an anti-armor missile system. In fact, a student should know how to

discriminate between enemy targets and other targets, and how to recognize threat vehicle silhouettes long before he ever learns how to actually operate the missile system. Therefore, perhaps only the last of the four skills/knowledges, knowledge of scanning techniques, might be retained. There is little doubt that all of these skills and knowledges are critical to overall mission success. The point is that at least three of them are not equipment operating procedures. Since we are concerned in our example only with operating procedures, a zero (0) would be assigned to the first three skills and knowledges in the Coverage Requirement Analysis. Those skills and knowledges would be taught as part of a separate course of instruction.

Example Analysis

In each chapter of this Guidebook, an example of a training situation for a hypothetical anti-armor missile system will be used to illustrate the procedures of TRAINVICE II and to highlight key points. For instructional purposes, only operating procedures for a contrived anti-armor missile system will be addressed in the examples. A partial list of operating procedures for crewmen of the anti-armor missile system is shown in Table 2.1, including the tasks, subtasks, skills and knowledges for the operation of the system.

Be thorough and specific with the Task Analytic methods and procedures you use in developing your initial list of tasks, subtasks, skills, and knowledges. Although, this document does not describe Task Analysis methods and systems, an accurate Task Analysis is a necessary input for conducting a TRAINVICE II analysis. An excellent

TASK

1. Load the Launch Tube

SUBTASK

1.1 Lock traversing unit in azimuth and elevation

SKILL

1.1.1 Operate traversing unit

KNOWLEDGES

1.1.2 Azimuth and elevation movement
1.1.3 Locking mechanism

SUBTASK

1.2 Remove encased missile from stowed position

SKILL

1.2.1 Remove casing materials from missile

KNOWLEDGES

1.2.2 Missile configuration
1.2.3 Casing materials

SUBTASK

1.3 Load encased missile

SKILLS

1.3.1 Loading procedure
1.3.2 Locking procedure

KNOWLEDGES

1.3.3 Safety aspects of launch tube preparation
1.3.4 Loading and locking mechanisms

TASK

2. Select a Target

SUBTASK

2.1 Visually select target

SKILL

2.1.1 Descrimination of enemy targets from other targets

KNOWLEDGES

2.1.2 Silhouettes of threat vehicles
2.1.3 Scanning techniques

SUBTASK

2.2 Swing traversing unit to align optical sight

SKILL

2.2.1 Operate traversing unit

KNOWLEDGES

2.2.2 Aximuth and elevation movement
2.2.3 Locking mechanism
2.2.4 Unlocking procedures

TASK

3. Connect Encased Missile

SUBTASK

3.1 Insure personnel are clear of firing danger zone

SKILL

3.1.1 Monitoring danger area

KNOWLEDGE

3.1.2 Danger zone areas

SUBTASK

3.2 Raise aiming lever

SKILL

3.2.1 Operating aiming lever

KNOWLEDGES

3.2.2 Position and function oa aiming lever

TASK

4. Acquire and Track Target

SUBTASK

4.1 Turn on and adjust vehicle light if needed

SKILL

4.1.1 Operation of light switch

KNOWLEDGE

4.1.2 Light switch operating procedures

SUBTASK

4.2 Operate focus control

SKILL

4.2.1 Perform focusing procedures

KNOWLEDGES

4.2.2 Locate focus contorl
4.2.3 Focusing contorl operation

SUBTASK

4.3 Operate traversing sight

SKILL

4.3.1 Perform traversing movement

KNOWLEDGES

4.3.2 Traversing sight location
4.3.3 Traversing sight procedures

SUBTASK

4.4 Operate optical sight

SKILL

4.4.1 Perform SOP for optical sighting

KNOWLEDGES

4.4.2 Optical sighting location
4.4.3 Optical sighting procedures

TASK

5. Launch Missile

SUBTASK

5.1 Lift trigger protective cover

SKILL

5.1.1 Unlock trigger protective cover

KNOWLEDGES

5.1.2 Trigger protective cover location
5.1.3 Unlocking procedures

SUBTASK

5.2 Press firing trigger

SKILL

5.2.1 Perform firing procedures

KNOWLEDGES

5.2.2 Firing trigger location
5.2.3 Missile firing procedures

TASK

6. Track Target Until Missile Impact

SUBTASK

6.1 Make continuous adjustments to keep crosshairs centered on target

SKILLS

6.1.1 Perform focusing procedures
6.1.2 Perform traversing procedures
6.1.3 Perfrom optical sighting procedures

KNOWLEDGES

6.1.4 Azimuth and elevation movement
6.1.5 Focus control location
6.1.6 Focusing control operation
6.1.7 Traversing sight location
6.1.8 Traversing sight procedures
6.1.9 Optical sight location
6.1.10 Optical sight procedures

Table 2.1
Operating TASKS, SUBTASKS, SKILLS and KNOWLEDGES for Anti-Armor Missile System

source of information on this topic is contained in the Interservice Procedures for Instructional Systems Development (IPISD) model contained in TRADOC Pamphlet 350-30. Refer to this document for assistance in establishing the task list, as well as the skills and knowledges associated with each task and subtask of interest.

A sample Consolidated List of skills and knowledges is shown in Table 2.2. Notice that when we compare the consolidated list (Table 2.2) with the original task list, Table 2.3*, the following redundant skills and knowledges are removed so that they occur in the consolidated list only once.

- Operate traversing unit (2.2.1, Table 2.3)
- Azimuth and elevation movement (2.2.2, Table 2.3)
- Locking mechanism (2.2.3, Table 2.3)
- Perform focusing procedures (6.1.1, Table 2.3)
- Perform traversing procedures (6.1.2, Table 2.3)
- Perform optical sighting procedures (6.1.3, Table 2.3)
- Azimuth and elevation movement (6.1.4, Table 2.3)
- Focus control location (6.1.5, Table 2.3)
- Focusing control operation (6.1.6, Table 2.3)
- Traversing sight location (6.1.7, Table 2.3)
- Traversing sight procedure (6.1.8, Table 2.3)
- Optical sight location (6.1.9, Table 2.3)
- Optical sight procedures (6.1.10, Table 2.3)

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* Table 2.3 has the same content as Table 2.1 (Operating Tasks, Subtasks, Skills and Knowledges for Anti-Armor Missle System) on page 2-6. The format has been changed to assist the reader in making a comparison.

Table 2.2

1. Load the Launch Tube
   - 1.1 Lock traversing unit in azimuth and elevation
     - 1.1.1 Operate traversing unit
     - 1.1.2 Azimuth and elevation movement
     - 1.1.3 Locking mechanism
   - 1.2 Remove encased missile from stowed position
     - 1.2.1 Remove casing materials from missile
     - 1.2.2 Missile configuration
     - 1.2.3 Casing materials
   - 1.3 Load encased missile
     - 1.3.1 Loading procedure
     - 1.3.2 Locking procedure
     - 1.3.3 Safety aspects of launch tube preparation
     - 1.3.4 Loading and locking mechanisms
2. Select a Target
   - 2.1 Visually select target
     - 2.1.1 Descrimination of enemy targets from other targets
     - 2.1.2 Silhouettes of threat vehicles
     - 2.1.3 Scanning techniques
   - 2.2 Swing traversing unit to align optical sight
     - 2.2.1 Unlocking procedures
3. Connect Encased Missile
   - 3.1 Insure personnel are clear of firing danger zone
     - 3.1.1 Monitoring danger area
     - 3.1.2 Danger zone areas
   - 3.2 Raise aiming lever
     - 3.2.1 Operating aiming lever
     - 3.2.2 Position and function of aiming lever
4. Acquire and Track Target
   - 4.1 Turn on and adjust vehicle light if needed
     - 4.1.1 Operation of light switch
     - 4.1.2 Light switch operating procedures
   - 4.2 Operate focus control
     - 4.2.1 Perform focusing procedures
     - 4.2.2 Locate focus control
     - 4.2.3 Focusing control operation
   - 4.3 Operate traversing sight
     - 4.3.1 Perform traversing movement
     - 4.3.2 Traversing sight location
     - 4.3.3 Traversing sight procedures
   - 4.4 Operate optical sight
     - 4.4.1 Perform SOP for optical sighting
     - 4.4.2 Optical sighting location
     - 4.4.3 Optical sighting procedures
5. Launch Missile
   - 5.1 Lift trigger protective cover
     - 5.1.1 Unlock trigger protective cover
     - 5.1.2 Trigger protective cover location
     - 5.1.3 Unlocking procedures
   - 5.2 Press firing trigger
     - 5.2.1 Perform firing procedures
     - 5.2.2 Firing trigger location
     - 5.2.3 Missile firing procedures
6. Track Target Until Missile Impact
   - 6.1 Make continuous adjustments to keep crosshairs contered on target

Consolidated List of Skills and Knowledges for each Task and Subtask

Table 2.3

1. Load the launch Tube
   - 1.1 Lock traversing unit in azimuth and elevation
     - 1.1.1 Operate traversing unit
     - 1.1.2 Azimuth and elevation movement
     - 1.1.3 Locking mechanism
   - 1.2 Remove encased missile from stowed position
     - 1.2.1 Remove casing materials from missile
     - 1.2.2 Missile configuration
     - 1.2.3 Casing materials
   - 1.3 Load encased missile
     - 1.3.1 Loading procedure
     - 1.3.2 Locking procedure
     - 1.3.3 Safety aspects of launch tube preparation
     - 1.3.4 Loading and locking mechanisms
2. Select a Target
   - 2.1 Visually select target
     - 2.1.1 Descrimination of enemy targets from other targets
     - 2.1.2 Silhouettes of threat vehicles
     - 2.1.3 Scanning techniques
   - 2.2 Swing traversing unit to align optical sight
     - 2.2.1 Operate traversing unit
     - 2.2.2 Azimuth and elevation movement
     - 2.2.3 Locking mechanism
     - 2.2.4 Unlocking procedures
3. Connect Encased Missile
   - 3.1 Insure personnel are clear of firing danger zone
     - 3.1.1 Monitoring danger area
     - 3.1.2 Danger zone areas
   - 3.2 Raise aiming lever
     - 3.2.1 Operating aiming lever
     - 3.2.2 Position and function of aiming lever
4. Acquire and Track Target
   - 4.1 Turn on and adjust vehicle light if needed
     - 4.1.1 Operation of light switch
     - 4.1.2 Light switch operating procedures
   - 4.2 Operate focus control
     - 4.2.1 Perform focusing procedures
     - 4.2.2 Locate focus control
     - 4.2.3 Focusing control operation
   - 4.3 Operate traversing sight
     - 4.3.1 Perform traversing movement
     - 4.3.2 Traversing sight location
     - 4.3.3 Traversign sight procedures
   - 4.4 Operate optical sight
     - 4.4.1 Perfrom SOP for optical sighting
     - 4.4.2 Optical sighting location
     - 4.4.3 Optical sighting procedures
5. Launch Missile
   - 5.1 Lift trigger protective cover
     - 5.1.1 Unlock trigger protective cover
     - 5.1.2 Trigger protective cover location
     - 5.1.3 Unlocking procedures
   - 5.2 Press firing trigger
     - 5.2.1 Perform firing procedures
     - 5.2.2 Firing trigger location
     - 5.2.3 Missile firing procedures
6. Track Target Until Missile Impact
   - 6.1 Make continuous adjustments to keep crosshairs centered on target
     - 6.1.1 Perform focusing procedures
     - 6.1.2 Perform traversing procedures
     - 6.1.3 Perform optical sighting procedures
     - 6.1.4 Azimuth and elevation movement
     - 6.1.5 Focus control location
     - 6.1.6 Focusing control operation
     - 6.1.7 Traversing sight location
     - 6.1.8 Traversing sight procedures
     - 6.1.9 Optical sight location
     - 6.1.10 Optical sight procedures

Original List of Operating Tasks, Subtasks, Skills and Knowledges for Anti-Missile System

The skills and knowledges removed from the original list could be found under more than one task and subtask. Therefore, they were removed because the CR Analysis is completed on a single skill or knowledge only once, not each time it appears.

A sample Coverage Requirements (CR) Analysis, with the consolidated skill and knowledge list entered, is shown in Figure 2-2. This is the first entry in what will hereafter be called the TRAINVICE II Master Worksheet. The worksheet lists all appropriate Tasks, Subtasks, and respective skills and knowledges. You must develop such a worksheet to begin your TRAINVICE analysis. On the worksheet (Figure 2-2), notice how the Coverage Requirement (CR) score of one or zero has been indicated for the skills and knowledges in Task 2.1. A score of "zero" was assigned to skill 2.1.1 and to knowledge 2.1.2. A score of "one" was assigned to knowledge 2.1.3. As mentioned earlier, it has been assumed in the example that target detection skills and knowledges (i.e., discrimination of enemy targets from other targets and knowing silhouettes of threat vehicles) have already been taught in another training situation. Therefore, these are rated with zeros on the TRAINVICE II Worksheet.

Note in Figure 2-2 that all skills and knowledges which received CR ratings of "zero" are retained in the data record. They are not discarded from the Consolidated List. Rather, their continuing presence will serve to indicate when a training device being evaluated offers unnecessary capability as well as for other reasons to be discussed later.

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS
1. Load the Launch Tube	CR
1.1 Lock traversing unit in azimuth and elevation	
1.1.1 Operate traversing unit	1
1.1.2 Azimuth and elevation movement	1
1.1.3 Locking mechanism	1
1.2 Remove encased missile from stowed position	
1.2.1 Remove casing materials from missile	0
1.2.2 Missile configuration	0
1.2.3 Casing materials	0
1.3 Load encased missile	
1.3.1 Loading procedure	1
1.3.2 Locking procedure	1
1.3.3 Safety aspects of launch tube preparation	1
1.3.4 Loading and locking mechanisms	1
2. Select a Target	
2.1 Visually select target	
2.1.1 Descrimination of enemy targets from other targets	0
2.1.2 Silhouettes of threat vehicles	0
2.1.3 Scanning techniques	1
2.2 Swing traversing unit to align optical sight	
2.2.1 Unlocking procedures	1
3. Connect Encased Missile	
3.1 Insure personnel are clear of firing danger zone	
3.1.1 Monitoring danger area	1
3.1.2 Danger zone area	1
3.2 Raise aiming lever	
3.2.1 Operating aiming lever	1
3.2.2 Position and function of aiming lever	1
4. Acquire and Track Target	
4.1 Turn on and adjust vehicle light if needed	
4.1.1 Operation of light switch	0
4.1.2 Light switch operating procedures	0
4.2 Operate focus control	
4.2.1 Perform focusing procedures	1
4.2.2 Locate focus control	1
4.2.3 Focusing control operation	1
4.3 Operate traversing sight	
4.3.1 Perform traversing movement	1
4.3.2 Traversing sight location	1
4.3.3 Traversing sight procedures	1
4.4 Operate optical sight	
4.4.1 Perform SOP for optical sighting	0
4.4.2 Optical sighting location	0
4.4.3 Optical sighting procedures	0
5. Launch Missile	
5.1 Lift trigger protective cover	
5.1.1 Unlock trigger protective cover	0
5.1.2 Trigger protective cover location	0
5.1.3 Unlocking procedures	0
5.2 Press firing trigger	
5.2.1 Perform firing procedures	1
5.2.2 Firing trigger location	1
5.2.3 Missile firing procedures	1
6. Track Target Until Missile Impact	
6.1 Make continuous adjustments to keep crosshairs centered on target	

Figure 2-2

TRAINVICE II MASTER WORKSHEET
Consolidated List of Skills/Knowledges With Final CR Rating

REMEMBER:

A "zero" CR rating simply states that the skill/knowledge need not be represented in the training device, even though that skill may be used on the job. Retaining these zero-rated skills throughout TRAINVICE II, however, helps further detection of device differences.

Summary

The main purpose of a CR Analysis is to identify all skills and knowledges required in a training device, as well as those not relevant to device capability. Key points covered by this chapter were:

- Establish a Consolidated List of operational skills and knowledges required by the Tasks and Subtasks.

- Rate each skill and knowledge on the Consolidated List with a "1" or "0" depending on whether the skill or knowledge is required in the training situation.

- Determining requirements for a coverage of skills and knowledges by a training device is the major objective of the CR Analysis.

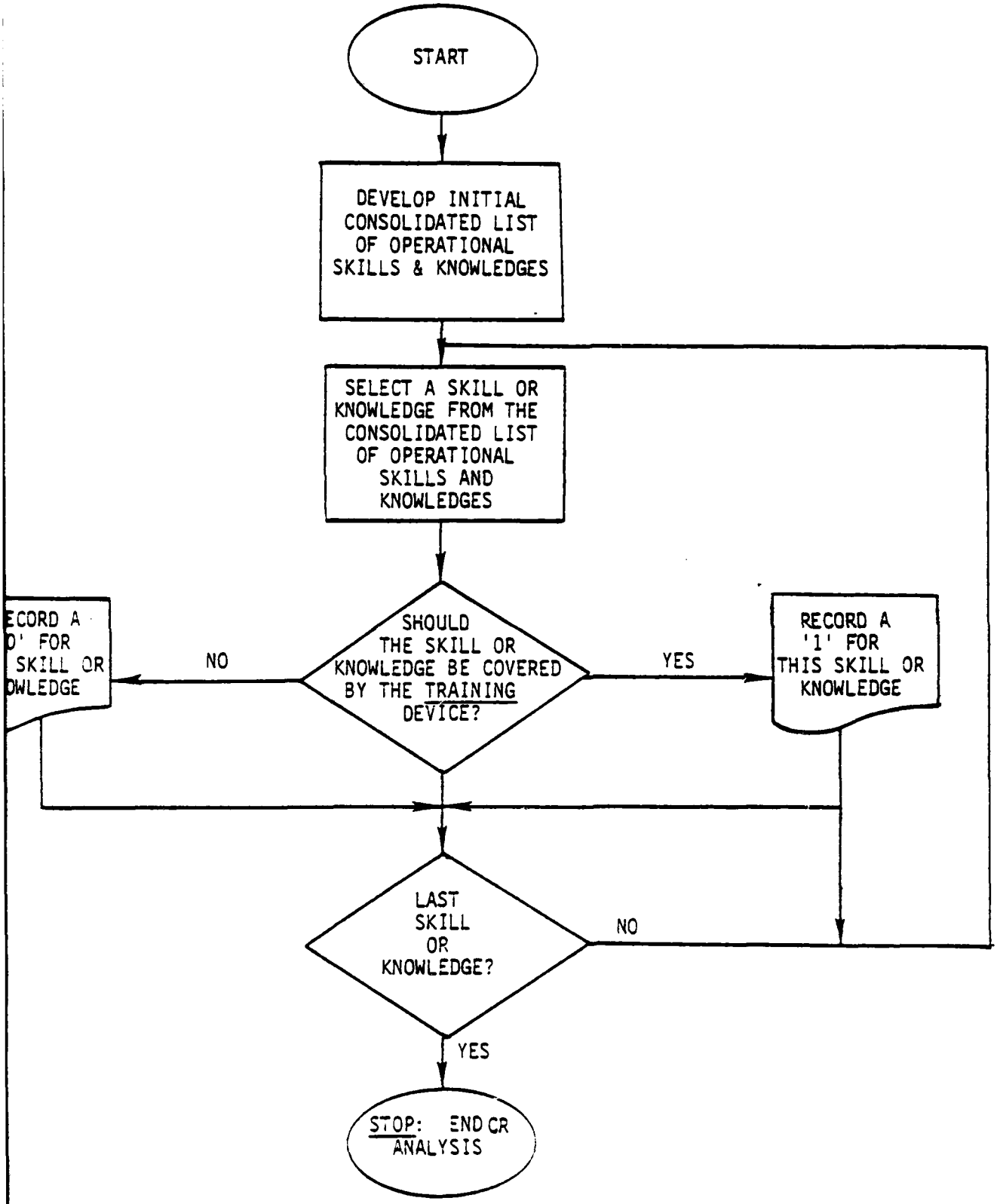

FIGURE 2-1. COVERAGE REQUIREMENTS ANALYSIS FLOWCHART

CHAPTER 3

COVERAGE ANALYSIS

The second component of the TRAINVICE II model is the Coverage (C) Analysis. The C Analysis is an assessment of whether the skills required in a training situation are actually represented in the training device or concept being evaluated.

> REMEMBER:
>
> The Coverage Analysis assesses whether the skills and knowledges required in a training situation (i.e., from the CR Analysis) are actually represented in a training device or concept.

Refer to the flow chart in Figure 1-1 to locate the C Analysis in the overall model. As you can see in Figure 1-1, the CR Analysis comes before the C Analysis in the model. These two components, as companion analyses, allow you to answer two separate but important questions:

- Are the required skills and knowledges actually represented in the training device being evaluated?
- Are any unnecessary skills and knowledges present in the training device or concept?

While the CR Analysis is performed only once in a TRAINVICE II application, the C Analysis must be completed for each training device or concept under evaluation. You should note that where the purpose of the CR Analysis was to translate operational skills and knowledges into training device requirements, the C Analysis determines if those required skills and knowledges are actually present in the training device being assessed. It is possible that two or more devices being compared may not cover the same skills and knowledges; this issue will be addressed later in the Guidebook.

Coverage (C) Analysis Procedure

The Coverage (C) Analysis, like the other TRAINVICE II components, can be used either as an integral element of the TRAINVICE II INDEX or independently to meet special assessment needs. In either application, the C Analysis is used when you want to compare two or more training devices or when you want to compare a single device to a set

of training requirements (i.e., the Consolidated List). In this section of the chapter, we will first describe the C Analysis procedure and then discuss how to interpret the C Analysis in relation to the CR Analysis.

A flow chart for the C Analysis component of TRAINVICE II is shown in Figure 3-1 on the next page. A foldout flow chart showing the C Analysis in relation to the CR Analysis is provided at the end of the chapter. From the CR Analysis, the C Analysis begins with the Consolidated List of operational skills and knowledges, as shown in the first box in Figure 3-1. After each skill or knowledge is selected, you must decide if that skill or knowledge is covered by the training device or concept. This decision process is represented by the first diamond shaped box in Figure 3-1.

If the skill or knowledge is covered by the training device, you should record a "1" in the C Analysis column on the worksheet corresponding to the skill or knowledge for the device under consideration. Similarly, if the skill or knowledge is not covered, record a "0" in the C Analysis column for that training device. This scoring procedure is identical to that used in the CR Analysis.

The C Analysis is continued until the last skill or knowledge is rated. The C Analysis is complete at this point. Your TRAINVICE II worksheet will have a C Analysis column completed for

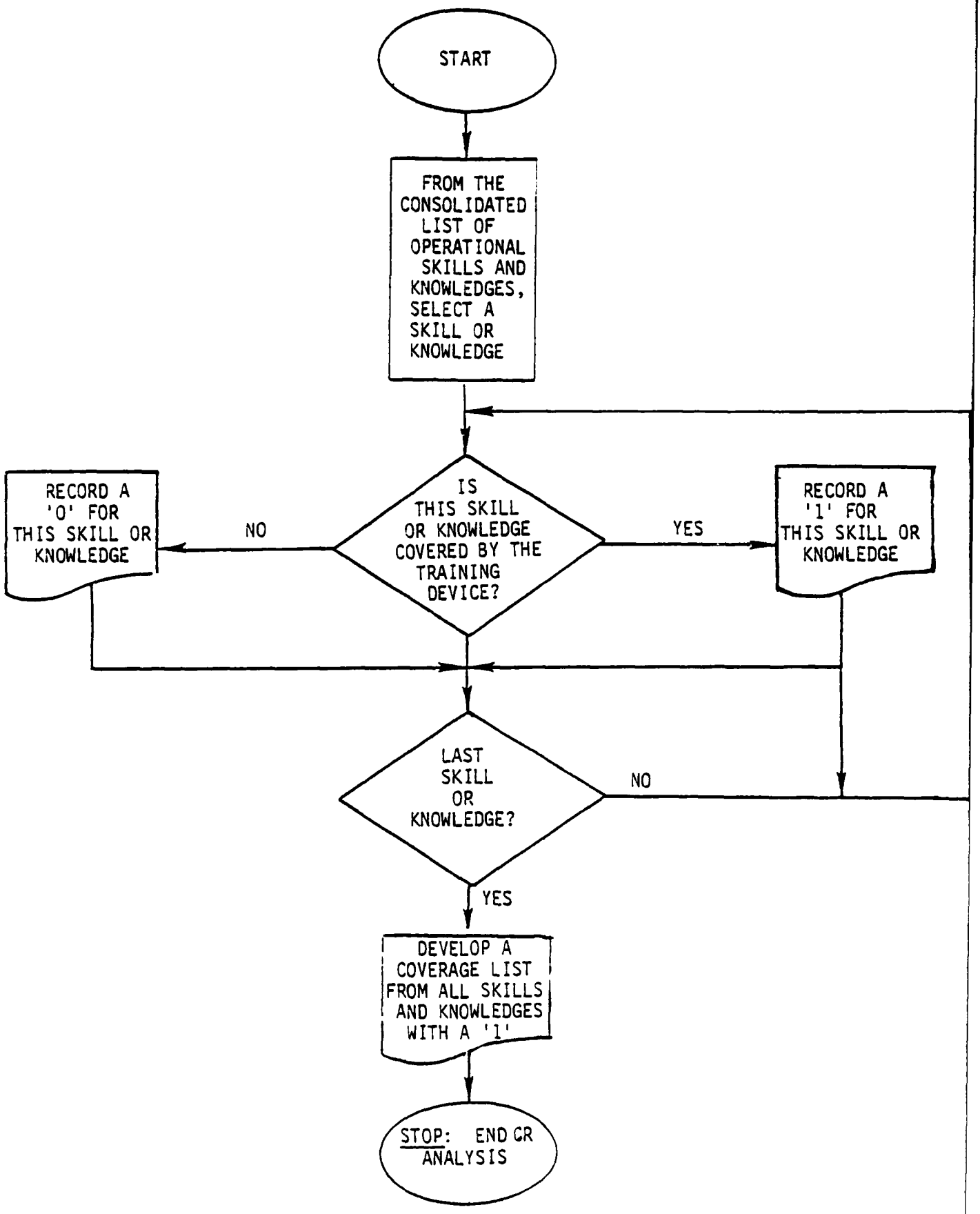

FIGURE 3-1. COVERAGE ANALYSIS FLOWCHART FOR USE WITH TRAINVICE II INDEX

each device being analyzed. In addition, the Coverage Requirements (CR) Analysis column will have also been recorded on the worksheet. Figure 3-2 (on page 3-10) illustrates how data are recorded for these analyses on the worksheet.

Regarding the C Analysis, it is important that the user understand that this analysis is concerned only with whether or not a skill/knowledge is covered by a training device; not with how well it is covered. For example, assume that you are dealing with a procedures trainer for the anti-armor missile system described in Chapter 2. Further, suppose that device is designed to teach the skills and knowledges of a particular tracking task, but is not very effective because of problems involving scale of the target and the optical sight. In such a case, you still give the skills and knowledges associated with this task a C rating of "1" in spite of these problems. The TRAINVICE II model will account for problems of instructional quality in later components of the overall analysis.

Interpretation Of The C Analysis In Relation To The CR Analysis

After both the CR Analysis and the C Analysis are completed for a particular training device, the results of these two analyses can be compared for each skill and knowledge. Figure 3-3 on the last page of this Chapter provides a flow chart of the C Analysis in relation to the CR Analysis. After a skill or knowledge is rated for coverage (i.e., "1" or "0"), each C Analysis rating can be compared to the

corresponding CR Analysis rating. This comparison serves as an early aid to the analyst in determining whether the C Analysis rating and the CR Analysis are the same for a particular device.

THE C-CR COMPARISON ASKS:

Did you rate a skill or knowledge the same on both the CR Analysis and the C Analysis? If the answer is "Yes", then you can conclude that at least the training device or concept has the appropriate coverage for that particular skill or knowledge.

A rating of "1" on both the CR and C Analyses, therefore, indicates that a required skill or knowledge is covered by the training device being evaluated. A rating of "0" on both the CR and C Analyses means a skill or knowledge is not required in the training and is appropriately not covered by the device or concept.

If, however, the CR and C ratings are unequal for a skill or knowledge, then only two alternatives are possible. First, a skill or knowledge could be rated "1" on the C Analysis and "0" on the CR Analysis. Second is the converse; that is, a "0" rating on the C Analysis and a "1" on the CR Analysis. Each has its own respective interpretation.

ALTERNATIVE #1	
IF:	"C = 1" when "CR = 0"
THEN:	An unnecessary skill or knowledge is covered by the device or concept

If detected early enough in the training development cycle, this skill should be eliminated from the device. The presence of this coverage, however, will not have a negative effect on the overall TRAINVICE II index.

ALTERNATIVE #2	
IF:	"C = 0" when "CR = 1"
THEN:	A required skill or knowledge is NOT covered.

Again, if it is early enough in the training cycle, skills rated as in ALTERNATIVE #2 should be included in the device or concept. If the device or concept is not modified to include such skills or knowledges, then its overall TRAINVICE II index will be degraded.

Example Analysis

Let us suppose we have two training devices, both of which are designed to teach operating procedures to the crew of the anti-tank missile system described in Chapter 2. These training devices are described in detail below:

- SHERMAN -- A simulator with most of the physical characteristics of an anti-armor missile system and having the capability to teach all procedural aspects of operation and firing at a target. In addition, it is able to simulate the backblast of an actual system. The Sherman unit also includes a vehicle light with appropriate switches for tracking targets. SHERMAN does not, however, fire inert missiles and therefore requires an external infrared (IR) target source in order to track targets and record hits or misses.

- PATTON -- A simulator very much like SHERMAN with the addition of a computer generated imagery system which simulates targets on a battlefield scene. With PATTON, a trainee can track and "destroy" a target and can be scored on tracking. No external IR source is needed. PATTON does not simulate the backblast of a missile firing. It can, though, be used either in a classroom or in a unit training environment.

A sample Coverage Analysis on SHERMAN and PATTON (using selected skills and knowledges of anti-armor missile operating procedures) is shown in Figure 3-2. Notice that Figure 3-2 includes two columns on the master worksheet for the C Analysis, one for each device being evaluated. From the Figure, Task Area #3, Connect Encased Missile, will be used to illustrate the Coverage Analysis procedure.

There are discrepancies between the two devices regarding coverage requirements (i.e., CR Analysis). Skill 4.1.1 and knowledge 4.1.2 are not required, as determined by the CR Analysis. As can be seen from the Worksheet (Figure 3-2), SHERMAN provides training for these while PATTON does not. Similarly, Skill 5.1.1 and knowledge 5.1.2 are not required, but can be found on the PATTON device. SHERMAN does not have the capability to include these skills and knowledges.

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS
1. Load the Launch Tube	CR	C	C
1.1 Lock traversing unit in azimuth and elevation			
1.1.1 Operate traversing unit	1	1	1
1.1.2 Azimuth and elevation movement	1	1	1
1.1.3 Locking mechanism	1	1	1
1.2 Remove encased missile from stowed position			
1.2.1 Remove casing materials from missile	0	0	0
1.2.2 Missile configuration	0	0	0
1.2.3 Casing materials	0	0	0
1.3 Load encased missile			
1.3.1 Loading procedure	1	1	1
1.3.2 Locking procedure	1	1	1
1.3.3 Safety aspects of launch tube preparation	1	1	1
1.3.4 Loading and locking mechanisms	1	1	1
2. Select a Target			
2.1 Visually select target			
2.1.1 Descrimination of enemy targets from other targets	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0
2.1.3 Scanning techniques	1	1	1
2.2 Swing traversing unit to align optical sight			
2.2.1 Unlocking procedures	1	1	1
3. Connect Encased Missile			
3.1 Insure personnel are clear of firing danger zone			
3.1.1 Monitoring danger area	1	1	1
3.1.2 Danger zone area	1	1	1
3.2 Raise aiming lever			
3.2.1 Operating aiming lever	1	1	1
3.2.2 Position and function of aiming lever	1	1	1
4. Acquire and Track Target			
4.1 Turn on and adjust vehicle light if needed			
4.1.1 Operation of light switch	0	1	0
4.1.2 Light switch operating procedures	0	1	0
4.2 Operate focus control			
4.2.1 Perform focusing procedures	1	1	1
4.2.2 Locate focus control	1	1	1
4.2.3 Focusing control operation	1	1	1
4.3 Operate traversing sight			
4.3.1 Perform traversing movement	1	1	1
4.3.2 Traversing sight location	1	1	1
4.3.3 Traversing sight procedures	1	1	1
4.4 Operate optical sight			
4.4.1 Perform SOP for optical sighting	0	0	0
4.4.2 Optical sighting location	0	0	0
4.4.3 Optical sighting procedures	0	0	0
5. Launch Missile			
5.1 Lift trigger protective cover			
5.1.1 Unlock trigger protective cover	0	0	1
5.1.2 Trigger protective cover location	0	0	1
5.1.3 Unlocking procedures	0	0	0
5.2 Press firing trigger			
5.2.1 Perform firing procedures	1	1	1
5.2.2 Firing trigger location	1	1	1
5.2.3 Missile firing procedures	1	1	1
6. Track Target Until Missile Impact			
6.1 Make continuous adjustments to keep crosshairs centered on target			

Figure 3-2

TRAINVICE II MASTER WORKSHEET

C Analysis for Two Training Devices

Where a skill or knowledge is required but not represented on a device, one might conclude that a worse situation exists than if unnecessary skills are covered. Any such conclusion, however, may be premature. A decision as to which is the better training device can be made only after consideration of additional information yet to be covered by TRAINVICE II. Also, does unnecessary coverage present problems in learning the required information? If not, perhaps this coverage can be tolerated. If the inclusion of unnecessary skills, however, does present a problem (perhaps by interfering with learning requirements) then such inclusions cannot be tolerated. Completing the TRAINVICE II index takes such complexities into account.

Summary

This concludes the discussion on Coverage (C) Analysis. The key points emphasized in this chapter were:

- The C Analysis assesses whether or not training requirements (i.e., skills and knowledges) are in fact represented in the device(s) under consideration.

- The C Analysis answers two questions:
  1. Are the required skills and knowledges represented in the training device or concept?

2. Are any unnecessary skills or knowledges present in the training device or concept?

- The C Analysis is concerned only with whether a skill or knowledge is covered by a training device; NOT with how well it is covered.

- If the CR and C Analyses are the same (i.e., both "1") the required skills and knowledges are adequately covered by the device.

- A CR of "1" and C of "0" means a required skill or knowledge is missing from the device.

- A CR of "0" and C of "1" means an unnecessary skill or knowledge is covered by the device.

- The Coverage Requirements Analysis and the Coverage Analysis results may be compared early in the TRAINVICE II procedure to identify tasks where training is lacking or where unnecessary training is being presented.

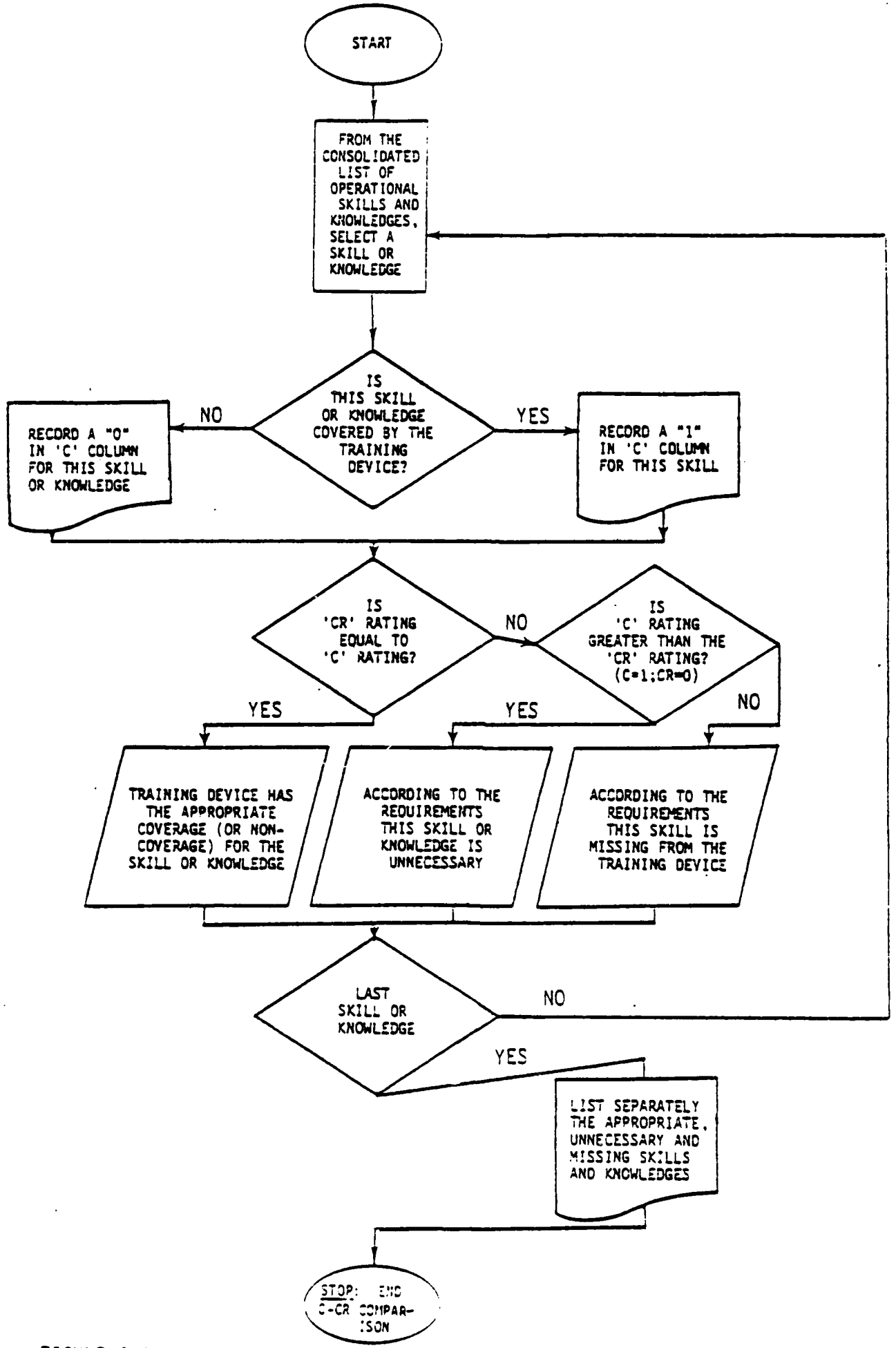

FIGURE 3-3. COVERAGE ANALYSIS FLOWCHART IN RELATION TO THE CR ANALYSIS

CHAPTER 4

TRAINING PROFICIENCY ANALYSIS

The third component of the TRAINVICE II model is the Training Proficiency (P) Analysis. This analysis determines the degree of proficiency which a trainee must attain for each skill and knowledge to be learned. The P Analysis is applied only to skills and knowledges both required and covered by a training device. In other words, the particular skill or knowledge must have received a "1" rating in both the CR and C anlayses in order for a P Analysis to be conducted for that skill/knowledge.

Only one overall Analysis is completed in TRAINVICE II regardless of the number of training devices being evaluated. This is because the degree of proficiency to be attained at the end of training (i.e., how well the trainee should be able to perform) is a standard which is independent of the training device used to achieve it. The decisions made in the P Analysis are based upon scaled criteria. Decision processes, therefore, will require more difficult judgements than the simple YES-NO approach serving prior TRAINVICE II components.

Training Proficiency Analysis Procedure

Refer to Figure 1-1, the TRAINVICE II flow chart, and find the location of the P Analysis in the overall model. The primary input

to this analysis, like the other TRAINVICE II analyses, is the Consolidated List of skills and knowledges. This input is represented by the top box in Figure 4-1, the foldout on the last page of this chapter.

The first step in the P Analysis is to select a skill or knowledge and to appraise the level of performance proficiency that a trainee should achieve at the completion of the training program. This judgement is made using a four point scale which ranges from a low of "1" to a high of "4". These P Analysis ratings are defined as follows (abbreviated definitions are provided in Figure 4-1):

PROFICIENCY RATING SCALE
1 = Should have limited knowledge of subject or skill; has at least been briefed on the subject or performed the skill once; however, system effectiveness would probably be seriously degraded by performance at this level of proficiency.
2 = Should have minimally competent knowledge of subject or skill for performing job or operating system; some errors in performance occur regularly, but basically the individual can sustain a minimally acceptable (or) "novice level" of performance.

3 = Should have adequate knowledge of subject or skill to assure reliable performance; errors in performance are infrequent to rare; performance can be characterized as smooth and experienced.

4 = Should have expert-level knowledge of subject and/or outstanding skill capability; errors in performance are rare; performance is excellent/superior.

After you assign a P value to a particular skill or knowledge, continue the process until all skills or knowledges on the list have been rated. Once the last skill is rated, you have completed the P Analysis.

As stated earlier, the P Analysis is a judgemental process, with the rating scale descriptors provided as guideline criteria. Be sure you understand that the scale is ordered from a low level of proficiency (P = "1") to a high level of expert performance (P = "4") In other words, the scale represents increasing levels (or degrees) of proficiency. If however, a skill or knowledge was previously given a CR score of zero (0) it obviously should not be rated for proficiency. Therefore, for skills or knowledges which are retained on the Consolidated List but which have received a zero (0) CR rating, a P value of zero (0) should be assigned.

NOTE:

P ratings of "1" and "2" should be carefully reviewed and reassessed to determine if those skills are actually required and necessary. If unncessary, change their CR rating to "zero" and rework the analysis.

After rating each of the skills or knowledges on the four point P scale and before proceeding to the next TRAINVICE II component, carefully review your P Analysis to be sure that the ratings you made were the most appropriate ones for the training situation. Outside consultation and expert review are advised for this effort.

Example Training Proficiency Analysis

Figure 4-2 shows an example of a TRAINVICE II worksheet. In Figure 4-2, Subtask 1.1 skills and knowledges pertain to the initial preparation of an anti-tank weapon for firing. In such a situation, it is important for the operator to be skilled, reliable, and experienced in operating the traversing unit and likewise knowledgeable about the locking mechanisms that control movements in azimuth and elevation. These skills and knowledges are not taught elsewhere in the curriculum and are considered to be very important safety procedures in which trainees should be reliably proficient. These skills and knowledges are thus rated "3" in our example analysis.

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS
1. Load the Launch Tube	CR	C	C	P
1.1 Lock traversing unit in azimuth and elevation				
1.1.1 Operate traversing unit	1	1	1	3
1.1.2 Azimuth and elevation movement	1	1	1	3
1.1.3 Locking mechanism	1	1	1	3
1.2 Remove encased missile from stowed position				
1.2.1 Remove casing materials from missile	0	0	0	0
1.2.2 Missile configuration	0	0	0	0
1.2.3 Casing materials	0	0	0	0
1.3 Load encased missile				
1.3.1 Loading procedure	1	1	1	4
1.3.2 Locking procedure	1	1	1	4
1.3.3 Safety aspects of launch tube preparation	1	1	1	4
1.3.4 Loading and locking mechanisms	1	1	1	4
2. Select a Target				
2.1 Visually select target				
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4
2.2 Swing traversing unit to align optical sight				
2.2.1 Unlocking procedures	1	1	1	4
3. Connect Encased Missile				
3.1 Insure personnel are clear of firing danger zone				
3.1.1 Monitoring danger area	1	1	1	3
3.1.2 Danger zone area	1	1	1	3
3.2 Raise aiming lever				
3.2.1 Operating aiming lever	1	1	1	3
3.2.2 Position and function of aiming lever	1	1	1	3
4. Acquire and Track Target				
4.1 Turn on and adjust vehicle light if needed				
4.1.1 Operation of light switch	0	1	0	0
4.1.2 Light switch operating procedures	0	1	0	0
4.2 Operate focus control				
4.2.1 Perform focusing procedures	1	1	1	3
4.2.2 Locate focus control	1	1	1	3
4.2.3 Focusing control operation	1	1	1	3
4.3 Operate traversing sight				
4.3.1 Perform traversing movement	1	1	1	3
4.3.2 Traversing sight location	1	1	1	3
4.3.3 Traversing sight procedures	1	1	1	3
4.4 Operate optical sight				
4.4.1 Perform SOP for optical sighting	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0
5. Launch Missile				
5.1 Lift trigger protective cover				
5.1.1 Unlock trigger protective cover	0	0	1	0
5.1.2 Trigger protective cover location	0	0	1	0
5.1.3 Unlocking procedures	0	0	0	0
5.2 Press firing trigger				
5.2.1 Perform firing procedures	1	1	1	4
5.2.2 Firing trigger location	1	1	1	4
5.2.3 Missile firing procedures	1	1	1	4
6. Track Target Until Missile Impact				
6.1 Make continuous adjustments to keep crosshairs centered on target				

Figure 4-2. TRAINVICE II MASTER WORKSHEET
Training Proficiecy Analysis Column Added

Subtask 1.3 skills and knowledges involve actually loading the missile into the launch tube. These skills and knowledges are peculiar to this weapon system and are considered to be highly important to the overall safe and efficient use of the system. They also impact on the rate of fire of the system which, in turn, impacts on its capability to service targets and thus mission success. Clearly, expert proficiency is called for here. Therefore, a rating of "4" is assigned to these skills and knowledges.

The user of TRAINVICE II should recall that sometimes required skills/knowledges (CR=1) may be covered by one device being assessed (C=1) but not by an alternative device (C=0). The rule applied here is: <u>If both a CR score of "1" and at least one C score of "1" exist, even though one of the two devices may have received a C score of "0", you still assign a P rating</u>. You may have already gussed that when the complete TRAINVICE II analysis is computed, the system not covering the skills/knowledges will lose score points. Skills and knowledges given a CR score of "0" for <u>all</u> devices being assessed, however, will <u>never</u> receive a P rating. The reason for this is that if a skill or knowledge is not required, then proficiency in that skill or knowledge is not relevant. Therefore, if retained on the list, a zero (0) is placed in the P column for these skills and knowledges. The P Analysis process is repeated for each skill and knowledge on the revised list (as shown in Figure 4-2) until the list is exhausted.

Summary

Key points discussed in this chapter were:

- The P rating pertains to training proficiency and not to mission criticality, although mission criticality may be a factor influencing the degree of training proficiency assigned to a skill or knowledge.

- Training proficiency is rated on a four point scale for each skill and knowledge on the revised list.

- Training proficiency ratings of "1" and "2" should be reviewed to determine if the skills and knowledges are actually required; expert review of all ratings is generally advised.

blank
4-8

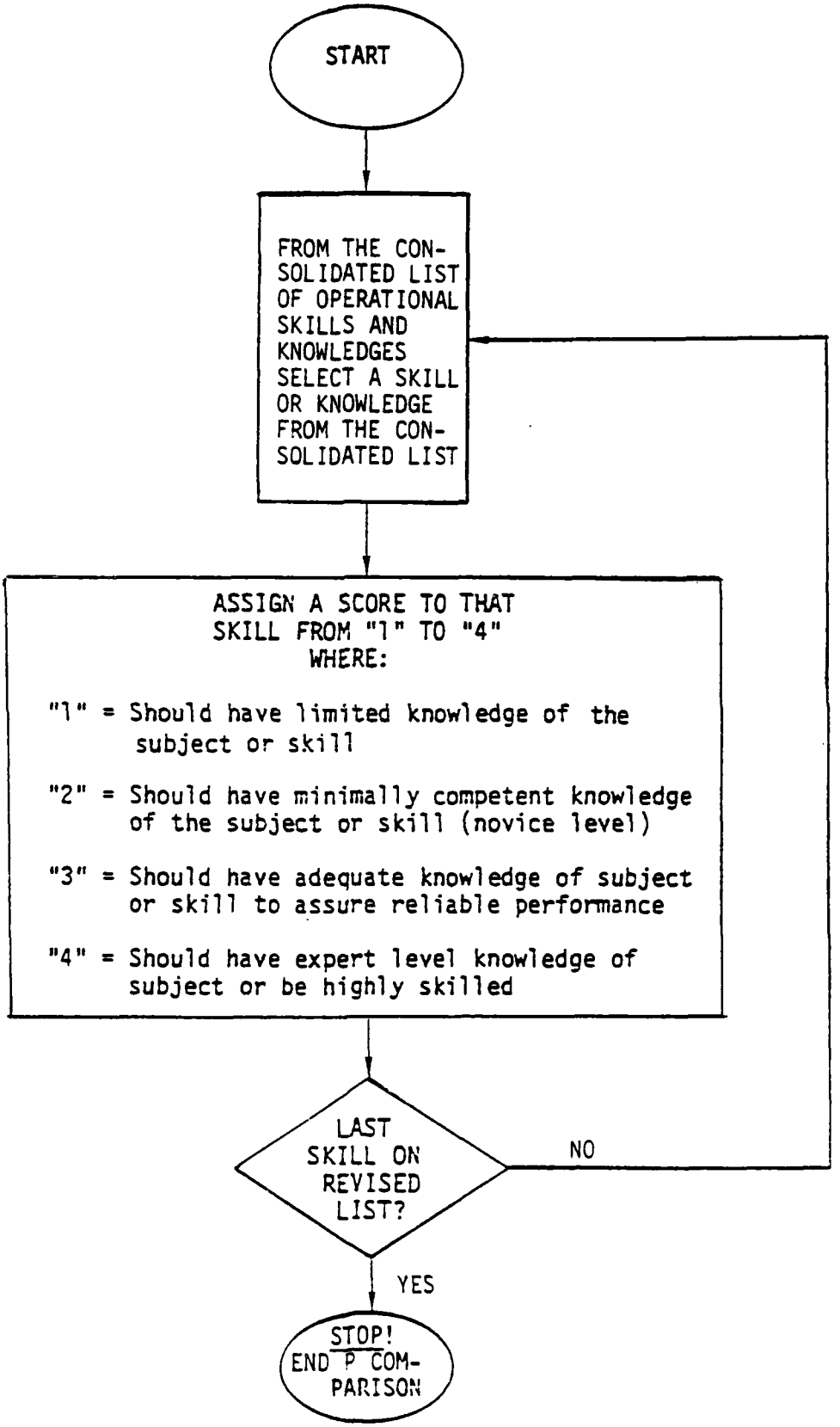

Figure 4-1. TRAINING PROFICIENCY ANALYSIS FLOWCHART

CHAPTER 5

LEARNING DIFFICULTY ANALYSIS

The fourth component of the TRAINVICE II model is the Learning Difficulty (D) Analysis. This analysis specifies the degree of learning difficulty associated with trainees' attaining the required level of proficiency (P) for a particular skill or knowledge. The procedures used in the Difficulty (D) Analysis are similar to those of the P Analysis (Chapter 4). Factors entering into the D Analysis are:

- the level of skill/knowledge proficiency to be attained by the trainee
- the entry-level capabilities of the trainees (pre-training skill/knowledge)
- the level of learning difficulty typically inherent in the particular skill or knowledge

The Learning Difficulty (D) Analysis, like the P Analysis, is completed only <u>once</u> in a TRAINVICE II model application, regardless

of the number of training devices being evaluated. The reason for conducting the D Analysis only once is because the degree of difficulty required to reach a specific level of proficiency is determined mainly by the gap between training objectives (i.e., required skills/knowledges) and the entry-level capabilities of trainees, rather than by characteristics of each training device.

Training Difficulty (D) Analysis Procedure

Refer to Figure 1-1, the TRAINVICE II flow chart, for the location of the D Analysis in the overall model. The procedure followed to calculate the D Analysis is shown in Figure 5-1 (at end of this Chapter). Begin first with the Consolidated List, and select a skill or knowledge to be assigned a Difficulty (D) score. Next, make a judgement regarding the degree of learning difficulty associcated with that skill or knowledge. This is done through the use of a four point scale ranging from a low of "1" to a high of "4". The D Analysis ratings are defined as follows (abbreviated definitions are provided in Figure 5-1):

DIFFICULTY RATING SCALE

1 = EASY: trainee can accomplish the activity once informed that it exists; virtually no practice or study is required.

2 = MODESTLY DIFFICULT: trainee can accomplish most of the activity subsequent to instruction with little practice or study; some of the activity does require minimal practice/study to sustain competent performance at the desired level of proficiency.

3 = DIFFICULT: trainee can accomplish the activity following instruction, but only with consistent practice and/or study.

4 = HIGHLY DIFFICULT: trainee requires "extensive instruction, practice and/or study to accomplish the activity; requirements of learning at least border on expert performance standards.

The last decision, (represented by the diamond shaped box in Figure 5-1) is whether the last skill has been assigned a D score. If not, return to the Consolidated List and continue the D Analysis until the last skill or knowledge has been rated. As was the case with the P Analysis procedure, retained skills or knowledges which received a CR rating of zero (0) should also be assigned a D value of 0. Skills or knowledges rated in the P Analysis, however, should

also have a D analysis completed.

Like the Proficiency Analysis, the Difficulty Analysis is a judgemental process wherein rating scale descriptors are provided as "guideline criteria". Your decisions about the learning difficulty of a skill or knowledge must, therefore, be based on careful review of certain relevant and interrelated factors.

First, you should review the proficiency level (P Analysis rating) assigned to the skill or knowledge. Second, you should know the expected entry-level capabilities of the prospective trainees. Third, you must guage the discrepancy between these first two variables and estimate "how far" trainees must come to attain the proficiency level required for a particular skill or knowledge. Fourth, you must estimate the nature and degree of difficulty normally inherent in teaching and learning the particular skill or knowledge. The analysis and synthesis of these factors is largely a judgemental process. Outside consultation and expert review of your D Analyses ratings is strongly advised.

Example Training Difficulty Analysis

The same skills and knowledges used for the Proficiency (P) Analysis are used in this present example to illustrate the points discussed in this chapter. A sample TRAINVICE II master worksheet with the D Analyses shown is presented in Figure 5-2.

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS
1. Load the Launch Tube	CR	C	C	P	D
1.1 Lock traversing unit in azimuth and elevation					
1.1.1 Operate traversing unit	1	1	1	3	3
1.1.2 Azimuth and elevation movement	1	1	1	3	3
1.1.3 Locking mechanism	1	1	1	3	3
1.2 Remove encased missile from stowed position					
1.2.1 Remove casing materials from missile	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0
1.3 Load encased missile					
1.3.1 Loading procedure	1	1	1	4	2
1.3.2 Locking procedure	1	1	1	4	2
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2
1.3.4 Loading and locking mechanisms	1	1	1	4	2
2. Select a Target					
2.1 Visually select target					
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2
2.2 Swing traversing unit to align optical sight					
2.2.1 Unlocking procedures	1	1	1	4	3
3. Connect Encased Missile					
3.1 Insure personnel are clear of firing danger zone					
3.1.1 Monitoring danger area	1	1	1	3	2
3.1.2 Danger zone area	1	1	1	3	2
3.2 Raise aiming lever					
3.2.1 Operating aiming lever	1	1	1	3	3
3.2.2 Position and function of aiming lever	1	1	1	3	3
4. Acquire and Track Target					
4.1 Turn on and adjust vehicle light if needed					
4.1.1 Operation of light switch	0	1	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3
4.2 Operate focus control					
4.2.1 Perform focusing procedures	1	1	1	3	2
4.2.2 Locate focus control	1	1	1	3	1
4.2.3 Focusing control operation	1	1	1	3	1
4.3 Operate traversing sight					
4.3.1 Perform traversing movement	1	1	1	3	2
4.3.2 Traversing sight location	1	1	1	3	1
4.3.3 Traversing sight procedures	1	1	1	3	1
4.4 Operate optical sight					
4.4.1 Perform SOP for optical sighting	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0
5. Launch Missile					
5.1 Lift trigger protective cover					
5.1.1 Unlock trigger protective cover	0	0	1	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0
5.1.3 Unlocking procedures	0	0	0	0	0
5.2 Press firing trigger					
5.2.1 Perform firing procedures	1	1	1	4	3
5.2.2 Firing trigger location	1	1	1	4	3
5.2.3 Missile firing procedures	1	1	1	4	3
6. Track Target Until Missile Impact					
6.1 Make continuous adjustments to keep crosshairs centered on target					

Figure 5-2. TRAINVICE II MASTER WORKSHEET
Learning Difficulty Analysis Column Added

Skills and knowledges in Subtask 1.1 pertain to the preparation of the anti-armor weapon system for firing. The inherent difficulty involved in these skills and knowledges is not considered to be great. However, the entry level skill of the trainees is thought to be very low since it is known that the trainees have never before seen the anti-armor weapon system. These skills and knowledges were rated "3" in the Proficiency (P) Analysis, indicating that a relatively high proficiency level is required. All of this considered, each of these skills and knowledges was subsequently given a Difficulty (D) Analysis rating of "3" because the trainees typically experience much difficulty in learning these types of skills and knowledges to the required proficiency level.

Note subtask 1.2 skills and knowledges, which are concerned with preparing the missile for loading. These are not rated because the skills and knowledges associated with this subtask were covered in the prerequisite course and reviewed in a subsequent field maintenance procedures course. Therefore, they were not required (from the CR Analysis) to be present in the device capability. Consequently, no Proficiency or Difficulty Analysis is required.

Subtask 1.3 skills and knowledges pertain to loading the missile into the launch tube. For these skills and knowledges, entry level skills of trainees were judged to be low and the level of proficiency required at the end of training judged to be high. These skills and knowledges are important to the safe and efficient use of the system

and were rated "4" in the Proficiency Analysis. Past experience and the experience of other trainers tells us that trainees find these skills and knowledges relatively easy to learn. They are judged, therefore, to be low in inherent difficulty and are thus assigned a "2". High proficiency requirements, therefore, do not mean that a skill will necessarily be difficult to learn.

The Difficulty Analysis has been completed in Figure 5-2 for the remaining skills and knowledges. Notice that only those skills and knowledges rated on the Proficiency Analysis are assigned a D Analysis rating.

> NOTE:
>
> As with the Proficiency (P) Analysis, skills with low scores on the Difficulty (D) Analysis should be examined closely for possible revision of their CR score to "0".

Summary

Key points emphasized in this chapter were:

- Learning Difficulty Analysis is based on the entry level skill repertoire of the trainees, the proficiency standards required for the skill and/or knowledge

to be learned, and the inherent level of difficulty for learning the skill and/or knowledge.

- Training Difficulty of each skill and/or knowledge is rated on a 4 point scale where:

  "1" = Easy

  "2" = Modestly Difficult

  "3" = Difficult

  "4" = Highly Difficult

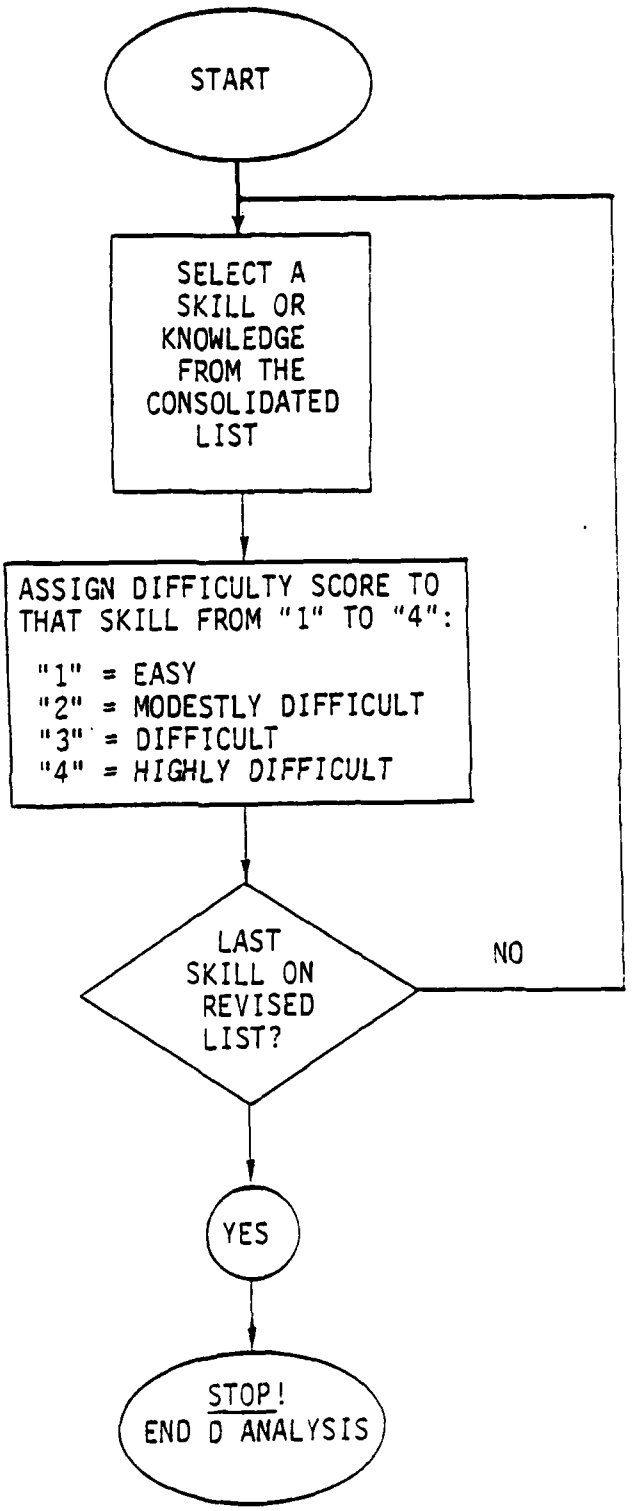

FIGURE 5-1. LEARNING DIFFICULTY ANALYSIS FLOW CHART

CHAPTER 6

PHYSICAL CHARACTERISTICS ANALYSIS

The fifth component of the TRAINVICE II model is the Physical Characteristics (PC) Analysis. This is the first of two anlayses that can be called "device characteristics analyses." Prior TRAINVICE II chapters focused on what skills are represented in the training device and why. Attention is now turned to how skills are taught or represented by physical components of the device. This chapter, therefore, focuses on analyzing the displays and controls used in a training device. The PC analysis is simply an assessment of how well the physical characteristics of the device support guidelines for "good instructional practice," regarding the skills and knowledges to be learned.

The PC Analysis must be conducted for each training device being evaluated. A separate worksheet column for each device, therefore, will be required.

> REMEMBER:
>
> Conduct a separate PC Analysis for each training device being evaluated.

Physical Characteristics (PC) Analysis Procedure

Refer to Figure 1-1 of the TRAINVICE II flow chart and locate the PC Analysis in the flow of the model. Note that there are three necessary inputs to the PC Analysis:

(1) the Physical Characteristics Learning Guidelines[4] (which are included in Appendix B),

(2) the Generic Characteristics List[5] (included in the Chapter), and

(3) the Consolidated List of Skills and Knowledges which has been used throughout TRAINVICE II.

The procedure you will follow to calculate the PC Analysis is shown in the foldout Figure 6-1 at the end of this Chapter.

The objective in conducting the PC Anlaysis is to determine how well the basic physical characteristics (i.e., displays and controls) of the particular training device will serve to implement good instructional practices in teaching each skill and knowledge. To achieve this objective, the PC Analysis produces two products,

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[4]U.S. Army, Interservice Procedures for Instructional Systems Development. TRADOC Pam 350-30, U.S. Training and Doctrine Command, Fort Monroe, Virginia, August 1975.

[5]Braby, R., Henry, J., Parrish, W., and Swope,W. A technique for choosing Cost-Effective Instructional Delivery Systems. TAEG Report No. 16, U.S. Navy, Training Analysis and Evaluation Group, Orlando, FL., 1975.

compares those two products, then assigns a rating to how well those products compare. The general procedure for conducting the analysis follows.

First, you will determine what type of behavior is required to accomplish a particular skill/knowledge on your consolidated task list. Next, you will determine what instructional practices are required to teach that type of learning. These instructional practices thus form a standard stating the qualities instruction should possess to teach each required skill or knowledge.

In the second phase of the PC Analysis, you will identify the relevant displays and controls (physical hardware) used by the training device to support instruction of each skill or knowledge. You will next determine how this physical hardware "stimulates learning" and how it permits the trainee to make "responses". These are the stimulus and response characteristics of the device.

Last, you will compare how well the stimulus and response characteristics of the device support the necessary guidelines for good instructional practice for each skill or knowledge.

Each of the steps involved in the PC Analysis is not, in itself, complicated. However, the analysis is more lengthy than others in TRAINVICE II and requires a number of careful judgements. Learning how to conduct the PC Analysis, therefore, can best be done by

"stepping through" an example rather than by general explanation. Throughout the example to follow, refer to each step of the analysis in the PC Analysis Flow chart provided in Figure 6-1. This will aid you in developing an understanding of the relationship between the PC Analysis components.

Example of Physical Characteristics (PC) Analysis

In this example, the fictitious "Sherman" and "Patton" training simulators will be used once again. You will recall that these were two similar anti-tank missile system training simulators. To aid your recall of their individual characteristics, a description of each device is repeated here:

- SHERMAN - A simulator with most of the physical characteristics of an anti-armor missile system and having the capability to teach all procedural aspects of system operation and firing at a target. In addition, it is able to simulate the backblast of an actual system. The SHERMAN unit also includes a vehicle light with appropriate switches for tracking targets. SHERMAN does not, however, fire inert missiles and therefore requires an external infrared (IR) target source in order to track targets and record hits or misses.

- PATTON - A simulator very much like SHERMAN with the addition of a computer generated imagery system which simulates targets on a battlefield scene. With PATTON, a trainee can track and "destroy" a target and can be scored on tracking. No external IR source is needed. PATTON does not simulate the backblast of a missile firing. It can, though, be used either in a classroom or in a unit training environment.

In this PC Analysis example, you will analyze the physical characteristics of the SHERMAN system. The same procedures you cover in the example will apply to PATTON or to any other comparable device. Later in this chapter, you will have a chance to actually compare the SHERMAN PC Analysis with one for the PATTON. For now, however, we will proceed through the example by analyzing SHERMAN only.

STEP #1: Select a skill/knowledge from the Consolidated List.

To begin the PC Analysis, we will select a single skill/knowledge from the Consolidated List used throughout TRAINVICE II. These skills and knowledges again serve as the basic inputs for analysis. To keep this present example brief yet relevant, we will anlayze only the first three skills/knowledges on our

Consolidated List. For your recall, these are skills/knowledges 1.1.1, 1.1.2 and 1.1.3 (shown in Table 2.2, Chapter 2):

1.1.1 Operate Traversing Unit

1.1.2 Azimuth and Elevation Movement

1.1.3 Locking the Mechanism

To complete the first step of the PC Analysis, simply record the skills/knowledges on a "PC Analysis Worksheet", which you must construct. The layout of the worksheet is shown in Figure 6-2 and in blank form in APPENDIX E. Note in Figure 6-2 that skills/knowledges 1.1.1, 1.1.2 and 1.1.3 have been recorded in Column I of the PC Analysis Worksheet.

Were you to complete the PC Analysis for all of the remaining skills/knowledges listed in Table 2.2, you would likely have to make several such worksheets. Since, however, we are using only three skills/knowledges for this example, only one worksheet will be necessary. In constructing your worksheet, be sure to leave space for the additional columns you will require later in the PC Analysis. These additional columns can be seen in Figure 6-2 and will be explained later in the example.

Before moving on to Step #2 of the PC Analysis example, be sure you understand that the two things done in Step #1 were simply:

I	II	III	IV	V	VI		VII
SKILL/KNOWLEDGE	BEHAVORAL CATEGORY	LEARNING GUIDE-LINES FOR GOOD INSTRUCTIONAL PRACTIVE	DISPLAY/CONTROL	APPLICABLE GENERIC CHARACTERISTICS	GENERAL CHARACTERISTICS	RATING	PHYSICAL CHARACTER-ISTICS SCORE $\frac{\text{SUM OF RATINGS}}{PC_{max}}$
1.1.1 Operate Traversing Unit	Performs gross motor skills	1, 2, 3, 4, 7, 10, 11, 12, 13, 14, 15	Device Traversing Subsystem	• STIMULUS CAPABILITY (1) Visual form, 1.5 (2) Visual movement, 2.3 (3) Visual spectrum, 3.3 (4) Scale, 4.1 (6) Tactile-Kinaesthetic, 6.2	• STIMULUS 1. Visual form 2. Visual movement 3. Visual spectrum 4. Scale 5. (Audio = N/A) 6. Tactile-Kinesthetic	 3 3 3 3 - 3	18/18
				• TRAINEE RESPONSE MODE (8) Broad movement manipulative acts	• TRAINEE RESPONSE MODE	3	
1.1.2 Azimuth & Elevation Movement	Classifying - Recognizing Patterns	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12	Optical Sight	• STIMULUS CAPABILITY	• STIMULUS 1. Visual form 2. Visual movement 3. Visual spectrum 4. Scale 5. (Audio = N/A) 6. (Tactile-Kinesthetic = N/A)	 3 3 3 3 - -	15/15
				• TRAINEE RESPONSE MODE	• TRAINEE RESPONSE MODE	3	
1.1.3 Locking Mechanism	Positioning Movement and recalling procedures	3, 4, 8, 11, 14, 16, 17, 18, 22, 23 25	Device Traversing Locking Mechanism	• STIMULUS CAPABILITY	• STIMULUS 1. Visual form 2. Visual movement 3. Visual spectrum 4. Scale 5. (Audio = N/A) 6. (Tactile-Kinesthetic = N/A)	 3 3 3 3 - -	15/15
				• TRAINEE RESPONSE MODE	• TRAINEE RESPONSE MODE	3	

Figure 6-2. PHYSICAL CHARACTERISTICS ANALYSIS WORKSHEET (calculated for the SHERMAN simulator)

STEP #1

(1.1) Select a skill or knowledge from the Consolidated List.

(1.2) Write the skill or knowledge in the first column of your analyst-made PC Analysis Worksheet (Figure 6-2).

As you might expect, eventually this simple procedure will be repeated until every skill and knowledge in the Consolidated List is entered into Column I of the worksheet. In our example, however, we will work only with the first three skills from Table 2-2.

Step #2: Assign Each Skill/Knowledge to a Behavioral Category.

The second step in the PC Analysis is to assign each skill/knowledge to a "behavioral category." A behavioral category describes what type of performance is required of the trainee. In other words, it is the type of learning behavior associated with performing the skill or knowledge. In TRAINVICE II, there are ten such behavioral categories to which any one skill/knowledge can be assigned:

BEHAVIORAL CATEGORIES
(1) Rule Learning and Using
(2) Classifying - Recognizing Patterns
(3) Identifying Symbols
(4) Detecting
(5) Making Decisions
(6) Recalling Bodies of Knowledge
(7) Performing Gross Motor Skills
(8) Steering and Guiding - Continuous Movement
(9) Positioning Movement and Recalling Procedures
(10) Voice Communications

Turn to APPENDIX A, Behavioral Category Definitions, and familiarize yourself in detail with the meaning of each of the ten behavioral categories. Once you have done so, return to this page and proceed with the PC Analysis example.

In Step #2 of the PC Analysis, you must compare each skill or knowledge (from your Consolidated List) to the ten behavioral categories in Appendix A, and decide to which behavioral category the skill/knowledge applies. For example, from Figure 6-2, compare the required skill 1.1.1, Operate the Traversing Unit with each of the ten behavioral categories in APPENDIX A. There seem to be three (3) possible categories into which that skill might fit:

#7 Performing Gross Motor Skills

#8 Steering and Guiding/Continuous Movement

#9 Positioning Movement and Recalling Procedures

After carefully studying the APPENDIX A definitions, it is apparent that skill 1.1.1, Operate the Traversing Unit best matches behavioral category #7, "Performing Gross Motor Skills." To complete Step #2 of the PC analysis, simply write that behavioral category in Column II of the PC worksheet; this is shown in Figure 6-2. As seen in Figure 6-2, the behavioral category "Performing Gross Motor Skills" has been entered in Column II beside skill 1.1.1, Operate Traversing Unit.

It is important to point out that a judgement was required to determine what behavioral category best described skill 1.1.1. To make such a judgement, you compare each required skill/knowledge with the behavioral category definitions given in APPENDIX A and identify the one category which, in your opinion, best matches the skill or knowledge. As Figure 6-2 shows, this procedure was also used for skills/knowledges 1.1.2, Azimuth and Elevation Movement and 1.1.3, Locking the Mechanism. The behavioral categories for those skills were then entered (respectively) in Column II of the PC worksheet.

Before proceeding to the next step in the PC Analysis, recall that this second step consisted of:

STEP #2

(2.1) Compare each required skill/knowledge to the ten behavioral categories given in APPENDIX A. Then dicide which of those categories best describes the "learning" required for the particular skill or knowledge you are considering.

(2.2) Write the behavioral category you select in Column II of the PC Worksheet, beside the skill/knowledge to which it applies.

Step #3: Identify Good Instructional Practices Associated With Learning Each Skill/Knowledge.

In Step #3 of the PC Analysis, you will determine what "good instructional practices" are recommended for developing the type of learning behavior you identified in the previous step. You will identify a "set" of these for each required skill or knowledge on the Consolidated List. This set of instructional guidelines, once determined, will remain standard for the skill/knowledge to which it applies. Thus, it forms a standard against which each training device is evaluated. The set of instructional guidelines will not change for the particular skill/knowledge from one device to the next.

In our example, we will limit our analysis to the same three skills/knowledges (1.1.1, 1.1.2, 1.1.3) used before. In brief, we will determine what "good instructional practices" are appropriate for teaching the behavioral category to which we assigned each skill/ knowledge in Step #2 (see Figure 6-2, Column II). The procedures for completing Step #3 of the PC Analysis follow.

Required skill 1.1.1, Operate Traversing Unit was judged to belong to behavioral category #7, "Performing Gross Motor Skills." In APPENDIX B of this manual, you will find an elaboration on each of the ten (10) behavioral categories in terms of learning guidelines for good instructional practice. Refer now to APPENDIX B, behavioral category #7: Performing Gross Motor Skills, and review the text under that category.

Behavioral category #7 offers twenty-five (25) guidelines for providing good instruction in learning gross motor skills. Some of these guidelines in Category #7 are preceded by the letter "P"; these apply to physical aspects of instruction and learning. Others are preceded with the letter "F"; those apply to functional aspects. Some guidelines are preceded by both letters "P" and "F" and they apply to both physical and functional aspects.

In Step #3 of the Physical Characteristics Analysis, you will be concerned only with behavioral category guidelines preceded by the letter "P" or "P/F". These will be the recommended guidelines

for good instructional practices regarding physical aspects of the generic type of training device (in our case, an anti-armor missile system) of interest. Functional aspects will be considered in the next chapter. In behavioral category #7, note also that there are two "P", and thirteen "P/F" guidelines. As a rule-of-thumb, expect that all physical guidelines (P's and P/F's) will apply to the generic type of training device(s) you are evaluating.

For some types of devices, guidelines found within a behavioral category might not be applicable to the type of training of interest. For example, take our first skill area 1.1.1, Operate the Traversing Unit. In APPENDIX B, behavioral category #7, find learning guideline No. 8 (P/F) and No. 9 (P/F). The first guideline, No. 8, recommends that a training device be capable of independently demonstrating a correct performance of the task. The second guideline, No. 9, is even more demanding. It recommends that the device can independently demonstrate the "component parts" of the task. These two capabilities might be essential in war-gaming on a CRT console, but they are simply not necessary in the SHERMAN and PATTON type simulators. Such devices need not "automatically" demonstrate the traversing movement, so these two guidelines do not apply in our case. However, guideline No. 10 is applicable to SHERMAN and PATTON type devices, this being:

> "The device provides for instructor or student description/demonstration of the component parts of the required task."

We retain learning guideline No. 10, therefore, as applicable to our type of training device.

To recap then, the type of simulator we are interested in need only permit manual description/demonstration of the task and its components by instructor or student. We will neither penalize nor give special credit to a particular device if it demonstrates task components automatically. Rather, we will simply ignore such capability because it is not relevant to our present training interests. If, however, the device does not provide for at least manual demonstration of the task and its components, it will lose points in TRAINVICE II scoring (this procedure to be described later).

For now, be sure you understand that guideline No. 10 (behavioral category #7) is retained, since it is appropriate to the type of simulator we are analyzing. Guidelines No. 8 and No. 9 are irrelevant and are thus rejected.

Carefully review each remaining "P" or "P/F" guideline in behavioral category #7 (APPENDIX B) for skill 1.1.1, Operate the Traversing Unit until you have covered all fifteen (15) listed there. When you have finished, you should have selected all of those that apply to the required skill/knowledge. Remember that once these have been selected, all devices being assessed (e.g., SHERMAN and PATTON will be compared to them). The guidelines are thus "standards"

for each skill and knowledge*. Regarding skill 1.1.1, Operate Traversing Unit, the physical characteristics guidelines selected from APPENDIX B for gross motor skills instruction are listed below. Each is stated in abbreviated form for notational convenience.

P	(1)	use of similar external cues
P	(2)	use of similar internal cues
P/F	(3)	present early knowledge of results
P/F	(4)	present external cues early
P/F	(7)	penalty follows incorrect response
P/F	(10)	learner can demonstrate task components
P/F	(11)	provide for practice on specific components
P/F	(12)	provide for practice under varied conditions
P/F	(13)	make evident objective and model performance during trainee practice period
P/F	(14)	provide short rest periods between practice periods
P/F	(15)	provide real-life distractions, interruptions (i.e., on-the-job).

The last phase of Step #3 in the PC Analysis is simply to enter these learning guidelines into Column III of your PC Worksheet (see Figure 6-2). Write them in abbreviated form or enter their "numeric"

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* NOTE: Depending on the complexity of the type of device you are analyzing, judging which guidelines are to be included can be a complicated job. It may be necessary to consult with experts, manufacturers, colleagues, peers, etc., to assure that your judgements are valid and complete.

code into worksheet Column III as shown in Figure 6-2. Whether you use abbreviated statements or numerics for recording the guidelines, Step #3 is completed once you record them in worksheet Column III beside the skill/knowledge they address. To review, Step #3 required you to do the following:

STEP #3

(3.1) For the required skill/knowledge, locate its behavioral category in APPENDIX B.

(3.2) Under the behavioral category in APPENDIX B, study the learning guidelines associated with physical characteristics (P or P/F). Select those learning guidelines appropriate to the type of device you are analyzing (most should apply).

(3.3) In Column III of the PC Worksheet, record the learning guidelines you selected beside their corresponding skill/knowledge (use abbreviated statements or numeric codes).

Step #4: Identify the Relevant Displays And Control Used By The Training Device.

Thus far in the PC Analysis, we have identified what type of learning behavior is required for each skill/knowledge and what

good instructional practices need be present in the physical characteristics of a training device to develop that learning behavior. In Step #4, we begin to determine whether the physical characteristics of the particular training device under evaluation adequately support those good instructional practices. Essentially, Step #4 of the PC Analysis requires an answer to one question:

> "What displays or controls are used by the particular training device to support instruction for each required skill or knowledge?"

In our present example, then, we will ask: "What displays or controls are used by the SHERMAN device to teach skill area 1.1.1, Operating the Traversing Unit?" The technical answer to this is the device traversing subsystem.

How was this answer determined? It was derived by consulting the technical manual on the SHERMAN device; by consulting with its designers; by asking experienced instructors/students; and by examining the SHERMAN simulator directly. How complicated an effort this information seeking might become will depend on the complexity of the device and the availability of resource materials and experts. Nonetheless, you may require considerable assistance and time in determining the answer to this question.

Once you have determined what displays or controls are used in teaching a skill or knowledge, the next task is quickly accomplished.

Simply record your description of the relevant display or control in Column IV of your PC Analysis Worksheet (see Figure 6-2). Record the description in the row with its corresponding skill/knowledge. In Figure 6-2, the display/control device traversing subsystem has been recorded in the row with the skill to which it applies; that being 1.1.1, Operate Traversing Unit. Training displays/controls have also been determined for skill/knowledge areas 1.1.2 and 1.1.3 and likewise entered in worksheet Column IV (Figure 6-2).

As regards identification of displays/controls employed by a device to support instruction of a skill or knowledge, the analyst must be aware of two important possibilities. First, different "makes" of training devices may employ different forms of displays/controls to implement instruction for the same skill or knowledge. While SHERMAN and PATTON, for example, are very similar and by-and-large employ very similar "hardware", it is possible they could have employed vastly different approaches or media for teaching (e.g. skill 1.1.1, Operate Traversing Unit.) The TRAINVICE II user should expect that displays and controls might differ from one device to the next, even though that hardware supports instruction for the same skill or knowledge. In this regard, the PC Analysis procedure is unaffected. The user simply enters a description of the display/control into Column IV of the PC Worksheet as prescribed earlier, and that display/control will be evaluated on its own merits. There is no expectation in TRAINVICE II that instructional hardware/media must be identical from one device to the next.

Second, recall that the Coverage (C) Analysis may have determined that a particular device has no displays/controls supporting instruction of the skill or knowledge (e.g., when CR=1, C=0). In such a case, simply enter the word NONE in Column IV of the PC Worksheet and enter "zero" scores into any subsequent scoring conducted on the missing displays or controls. This same procedure is used for situations where CR=0, and C=1. PC Analysis scoring procedures will be explained later in this chapter.

REMEMBER:

(1) It is expected that instructional design characteristics may differ from one device to the next for any one skill or knowledge. TRAINVICE II procedures take this into account.

(2) Devices which do not cover a required skill/knowledge will receive zero scores in the PC Analysis.

To summarize, Step #4 of the PC Analysis simply requires the analyst to:

STEP #4
(4.1) Determine what displays or controls are used by the training device in teaching the required skill/knowledge.
(4.2) Enter a description of these displays or controls in Column IV of your PC Analysis Worksheet. Enter the term NONE in the column if no displays/controls support the particular skill/knowledge.

Step #5: Assign Generic Stimulus and Response Characteristics To Displays and Controls.

In order to evaluate how well the training device's displays and controls serve instruction and learning, we must first identify how this physical hardware is intended to support the teaching-learning process. Specifically, we need to know how it is designed to implement instruction; that is, what its stimulus characteristics are and how it accommodates learner responses (i.e., what the response mode is). Once these stimulus and response characteristics are identified, we will be able to determine how well they support the good instructional practices (from Step #3) necessary to accomplish training objectives.

In sum, this step of the PC Analysis must answer two questions for each display or control:

1) What are the characteristics of the display or control as a learning stimulus? (In what manner does it cue, prompt or otherwise provide for instruction?)
2) What is the primary response mode required by the display or control? (Once the instructional stimulus is provided, what form of response does it require the trainee to make?)

When these two questions have been answered in this Step, we will then be in a position to determine how well the training device's "physical characteristics" (i.e., displays/controls) support the good instructional practices needed to learn the required skills and knowledges. Step #5 will require some very careful study, judgements and (possibly) consultation with experts on the user's part. Still, the procedural mechanics of the step are simple and follow below.

Having identified all relevant displays/controls in Step #4, our objective in Step #5 is to identify the stimulus characteristics (stimulus capability) and learner response mode associated with each of those displays or controls. The first display/control we will assess in the SHERMAN device is the Device Traversing Subsystem (see Column IV, Figure 6-2). This subsystem is associated with skill 1.1.1, Operate Traversing Unit.

To determine the stimulus capabilities of the Device Traversing Subsystem, we must first know something about its displays and controls. We turn to our usual sources of information: manufacturers of the simulator; instructors/students experienced in using it; its technical manuals; the simulator itself, etc. The purpose of this study will first be to learn about the stimulus characteristics of the Device Traversing Subsystem. Fortunately for our analysis, there are only a limited number of characteristics (or) capabilities a stimulus can possess. These stimulus capabilities can be summarized under six (6) categories and are presented in Figure 6-3, which was taken from Braby, et.al. (1975). Review these six categories of possible stimulus characteristics presented in the figure.

As you likely noted in Figure 6-3, within each major stimulus category (for example #1 Visual Form) there are a number of possible capabilities the display/control can have as a stimulus. It might serve as a visual form stimulus but of the "visual alphanumeric" type (subcategory 1.1). For example, the contents of a typical page of computer printout (or) a digital timer are visual forms employing alphabetic and/or numeric stimuli. Another visual form which a stimulus might take could be of "pictoral" nature (e.g., a battlefield image projected on a screen) as defined by subcategory 1.2. Several stimulus capability alternatives are described within each of the six major (generic) categories in Figure 6-3.

STIMULUS CAPABILITIES [1]

(1) VISUAL FORM

1.1 Visual Alphanumeric - words, numbers and other symbols presented graphically.

1.2 Visual Pictorial, Plane - a two-dimensional image, a representation in the form of a photograph or drawing.

1.3 Visual Line Construction, Plane - a two-dimensional figure made of lines, such as a mathematical curve or graph.

1.4 Visual Object, Solid - a three-dimensional image or reality that is viewed from exterior perspectives.

1.5 Visual Environment - A three-dimensional image or reality that is viewed from inside.

(2) VISUAL MOVEMENT

2.1 Visual Still - a static visual field, as with a still photograph, drawing, or printed page.

2.2 Visual Limited Movement - a basically static visual field with elements that can be made to move, as with an animated transparency or simple panel with switches that move.

2.3 Visual Full Movement - a visual field in which all elements can move, as with a motion picture, flight simulator, or operational aircraft.

2.4 Visual Cyclic Movement - a visual field which moves through a fixed sequence and then repeats the sequence in a repetitive manner, as with a film loop.

(3) VISUAL SPECTRUM

3.1 Black and White - a visual field composed of either black or white elements, as with the printed page or line drawings.

3.2 Gray Scale - a visual field composed of black, white and continuous gradations of gray, as with a black and white photograph or television picture.

3.3 Color - a visual field composed of various segments of the visual spectrum, as with color television or motion pictures.

(4) SCALE

4.1 Exact Scale - actual visual field or a one-to-one replication of that field as with a full-sized mock-up, simulator, or operational system.

4.2 Proportional Scale - a representation of reality in other than full scale, such as a scaled model map or photograph.

(5) AUDIO

5.1 Voice Sound Range - a limited quality of sound which enables spoken words to be used as the medium of communications, but not suited to more demanding tasks, such as music or sound recognition exercises.

5.2 Full Sound Range - a quality of sound reproduction that contains all the significant elements of the sound and is suited to the demanding task of sound recognition exercises.

5.3 Ambient Sounds - a complex sound environment with sounds emanating from various sources and from various directions, including background noise and task significant sounds.

(6) TACTILE-KINESTHETIC

6.1 Tacticle Cues - signals received through the sense of touch, inlcuding sensations related to texture, size or shape.

6.2 Internal Stimulus Motion Cues - the sensations felt by a person when he moves his arm, leg, fingers, etc.

6.3 External Stimulus Motion Cues - the sensations felt by a person whe he is moved by some outside force in such a way that his body experiences roll, pitch, yaw, heave, sway and/or surge.

TRAINEE RESPONSE MODE [2]

(1) Covert Response - a response which the trainee creates in his mind but does not express in an obserbable manner.

(2) Multiple Choice - a response mode in which a trainee selects a response from a limited set of responses.

(3) Pre-programmed Verbal Performance - a response mode in which a trainee creates a short answer to a question having a limited set of correct answeres.

(4) Free-Style Written Performance - a response mode in which a trainee writes a response in his own words.

(5) Decision Indicator - a verbal or perceptual motor response in which the trainee indicates that he has made a divergent type decision.

(6) Voice Performance - a response mode in which a trainee speaks, including conversation.

(7) Fine Movement Manipulative Acts - a response mode in which a trainee makes discrete and small movements of dials, switches, keys or makes sensitive adjustments to insturments. Act may involve use of small instruments.

(8) Broad Movement Manipulative Acts - a response mode in which a trainee makes large movements of levers or wheels on large pieces of equipment or by the use of equipment or by the use of hand held tools.

(9) Tracking - a response mode in which a trainee continuously controls a constantly changing system, such as steering an automobile or holding a compass bearing in steering a ship.

(10) Procedural Manipulative Acts - a response mode in which a trainee performs the sequence of steps in a procedure, such as in the carrying out of the items on the checklist for pre-flighting an aircraft or turning on a radar system.

[1] From just a few to many of these capabilities may apply to the device/control being characterized.

[2] Only one type of response will be made by the trainee to the corresponding stimulus.

Figure 6-3

GENERIC STIMULUS CHARACTERISTICS AND CORRESPONDING TRAINEE RESPONSE MODES

These within-category descriptions are provided to help you decide which generic stimulus capabilities apply to the display/control you are evaluating. Remember, you may have to call on outside experts, colleagues, etc., to make your judgement in complex cases. For the present, however, let us see how all of this applies to the SHERMAN device.

In our present case, assume that we thoroughly understand all parts of the SHERMAN's Device Traversing Subsystem used to support teaching the skill 1.1.1, Operating Traversing Unit. We now compare what we know about its displays/controls to the list of stimulus capabilities (generic characteristics) provided in Figure 6-3. We ask:

> "Which of these six generic characteristics (stimulus capabilities) are possessed by the SHERMAN's Device Traversing Subsystem?"

We conclude the following stimulus capabilities apply to SHERMAN:

(1) Visual Form - A field simulator using the actual field environment. It provides visual form stimuli as solid visual objects (1.4) and has the real visual environment (1.5) in three-dimensional images.

(2) Visual Movement - Simulator provides full visual movement (2.3) through a visual field in which any/all elements can move.

(3) Visual Spectrum - Simulator provides color (3.3) since it employs real-life environment.

(4) Scale - Simulator is exact scale (4.1).

(6) Tactile Kinesthetic - Simulator uses external stimulus motion cues (6.3).

We now record these applicable generic characteristics in Column V of Figure 6-2, in the same row as skill 1.1.1, Operate Traversing Unit.

> NOTE:
>
> #5 Audio - It was determined that this generic stimulus characteristic was NOT APPLICABLE to the SHERMAN Device Traversing Subsystem; therefore audio was deleted from the above list.

Having characterized the "stimulus" aspect of SHERMAN's Device Traversing Subsystem, we next ask:

"In what way is the trainee required to respond when employing SHERMAN's Device Traversing Subsystem? " That is What response mode is required of the learner?

Fortunately, only a limited number of learning responses can be used by a trainee, and for all practical purposes, only one response at a time can be made to the instructional stimulus. Therefore, the analyst need select only one learner response mode appropriate to the stimulus with which it is associated. This selection is made from ten possible alternatives defined in the TRAINEE RESPONSE MODE LIST. This list is also found in Figure 6-3. It should be noted that for a display only, a response may not always be involved.

In the case of the SHERMAN's Device Traversing Subsystem, it was determined that the applicable Response Mode was:

Mode #8 - Broad Movement Manipulative Acts
(i.e., hand/arm guided traversing movements)

The Trainee Response Mode (in this case, Mode #8) is also entered into Column V on the PC Analysis Worksheet, as shown in Figure 6-2. The applicable generic characteristics for both stimulus and trainee response mode have thus been identified and entered into Column V for the display/control associated with skill area 1.1.1, Operate Traversing Unit.

Note that in Column V of Figure 6-2, these procedures have also been applied to skill/knowledge areas 1.1.2 and 1.1.3 for SHERMAN. Ultimately, all skills/knowledges would likewise be evaluated with respect to identifying their applicable generic characteristics. To review briefly, Step #5 of the PC Analysis requires the following:

STEP # 5

(5.1) For each display/control identified in step #4, define its:

(1) generic stimulus characteristics

(2) corresponding trainee response mode

(5.2) Record these in Column V of the PC Analysis Worksheet, for the skill/knowledge with which they are associated.

Step #6: Rate How Well Each Generic Characteristic Of The Display/Control Supports the Good Instructional Practices.

Early in the PC Analysis, we determined what "good instructional practices" were required to teach skill 1.1.1, Operating Traversing Unit. We then determined what "generic stimulus and response characteristics" were provided by displays and controls for getting this job done. Now we will evaluate how well these generic characteristics actually help do the job. In Step #6, this is accomplished as follows.

Take the first generic stimulus characteristic (from Column V of the PC Analysis Worksheet, Figure 6-2) and compare it to the "set" of the good instructional practices (Column III, Figure 6-2) associated with skill 1.1.1, Operate Traversing Unit. For our present example, we would ask:

"How well does generic stimulus characteristic #1 Visual Form (from Column V) serve the total set of learning guidelines in Column III?" Next, how well does #2 Visual Movement serve the same set of guidelines; next, #3 Visual Spectrum, and so on right through the last generic characteristic.

This same evaluation process is also applied to the trainee response mode (Column V, Figure 6-2). Of course, if any generic characteristic does not apply (as was the case with #5, "audio") it is not rated.

To make your comparison of each generic characteristic with its corresponding set of good instructional practices, you must assign a rating to how well each generic characteristic does the job of implementing those practices. For example, you rate how well stimulus characteristic #1 Visual Form measures up to implementing the good instructional practice guidelines necessary for teaching skill area 1.1.1, Operating Traversing Unit. To do this, use the following rating scale:

0 = Extremely deficient implementation of guidelines (or) no implementation at all.

1 = Partially proficient implementation of guidelines; at least minimal implementation is achieved.

2 = Proficient implementation of guidelines; implementation is adequate to good instructional quality.

3 = Highly proficient implementation of guidelines; implementation is of exceptional quality (or) is identical with guidelines.

In effect, the overall rating you give each generic characteristic should be an approximate "average" of how well the characteristic implements the set of learning guidelines with which it is associated. In cases where the C Analysis determined that no displays/controls were on the device to cover the required skill/knowledge, simply enter a zero (0) in Column VI of the PC Worksheet for that skill/knowledge area.

Refer now to Figure 6-2, Column VI. Notice that the Device Traversing System's generic characteristics and response mode were all rated "3". That is an exceptionally high rating. However, remember that the SHERMAN is a life-sized simulator replicating actual field equipment with a very high degree of fidelity; thus its physical characteristics (displays/controls) are highly proficient

in implementing the good instructional practices required for the skills/knowledges, and are so rated . The point is that degree to which, instructional practices are adequately implemented, and not physical realism, causes higher PC scores.

REMEMBER

If the skill/knowledge is covered by the device (C=1), then:

- At least one generic stimulus characteristic must be selected and rated.
- A response mode must be selected and rated.

The total generic characteristics score for each skill/knowledge is recorded in Column VII of the PC Analysis Worksheet (Figure 6-2). Notice for skill 1.1.1 that "18" points was attained when the Column VI ratings were summed, and this total was recorded in Column VII. Eighteen points happened to be the maximum number of points the SHERMAN's device traversing subsystem could receive in this case, so its score is recorded as "18/18". The reason for this maximum is as follows.

Recall from Column VI of the worksheet that 5 stimulus characteristics (audio did not apply) and the trainee response mode

were rated. This made for rating a total of six generic characteristics. Since the highest rating any generic characteristic can receive was "3", the maximum possible score attainable was thus 6 x 3 = "18". The maximum possible score attainable by a device in the PC Analysis (for any one skill or knowledge) is called the "PC_{max}" score. Note again in Column VII of the worksheet how SHERMAN's PC score for skill 1.1.1 is entered as "18/18". This is to say that a PC score of eighteen points was attained out of a PC_{max} of eighteen. The TRAINVICE II user must <u>always</u> compute the PC_{max} score for each skill/knowledge since the PC_{max} will be critical to calculating the final TRAINVICE II index. Both the PC scores and their corresponding PC_{max} scores are to be recorded on the master TRAINVICE II Worksheet as shown in Figure 6-4.

ALWAYS CALCULATE AND RECORD

EACH PC_{max} SCORE

FOR ITS CORRESPONDING PC SCORE

$$PC_{max} = \left[\begin{array}{l}\text{No. of}\\ \text{applicable}\\ \text{generic}\\ \text{characteristics}\end{array}\right] \times \left[\begin{array}{l}\text{Highest Possible}\\ \text{rating value,}\\ \text{which is } \underline{\text{always}}\\ \text{three (3).}\end{array}\right]$$

After the scores have been summed and recorded for the first skill/knowledge, we move to the next skill/knowledge and repeat the

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS	SHERMAN PHYSICAL CHARACTERISTIC SCORE	PATTON PHYSICAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE PC SCORE	PATTON MAXIMUM POSSIBLE PC SCORE
1. Load the Launch Tube	CR	C	C	P	D	PC	PC	PC_{max}	PC_{max}
1.1 Lock traversing unit in azimuth and elevation									
1.1.1 Operate traversing unit	1	1	1	3	3	18	18	18	18
1.1.2 Azimuth and elevation movement	1	1	1	3	3	15	15	15	15
1.1.3 Locking mechanism	1	1	1	3	3	15	15	15	15
1.2 Remove encased missile from stowed position									
1.2.1 Remove casing materials from missile	0	0	0	0	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0	0	0	0	0
1.3 Load encased missile									
1.3.1 Loading procedure	1	1	1	4	2	18	18	18	18
1.3.2 Locking procedure	1	1	1	4	2	18	18	18	18
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2	18	18	18	18
1.3.4 Loading and locking mechanisms	1	1	1	4	2	18	18	18	18
2. Select a Target									
2.1 Visually select target									
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2	13	21	21	21
2.2 Swing traversing unit to align optical sight									
2.2.1 Unlocking procedures	1	1	1	4	3	18	18	18	18
3. Connect Encased Missile									
3.1 Insure personnel are clear of firing danger zone									
3.1.1 Monitoring danger area	1	1	1	3	2	15	0	15	15
3.1.2 Danger zone area	1	1	1	3	2	15	0	15	15
3.2 Raise aiming lever									
3.2.1 Operating aiming lever	1	1	1	3	3	18	18	18	18
3.2.2 Position and function of aiming lever	1	1	1	3	3	18	18	18	18
4. Acquire and Track Target									
4.1 Turn on and adjust vehicle light if needed									
4.1.1 Operation of light switch	0	1	0	0	0	0	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3	0	0	0	0
4.2 Operate focus control									
4.2.1 Perform focusing procedures	1	1	1	3	2	18	18	18	18
4.2.2 Locate focus control	1	1	1	3	1	18	18	18	18
4.2.3 Focusing control operation	1	1	1	3	1	18	18	18	18
4.3 Operate traversing sight									
4.3.1 Perform traversing movement	1	1	1	3	2	18	18	18	18
4.3.2 Traversing sight location	1	1	1	3	1	18	18	18	18
4.3.3 Traversing sight procedures	1	1	1	3	1	18	18	18	18
4.4 Operate optical sight									
4.4.1 Perform SOP for optical sighting	0	0	0	0	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0	0	0	0	0
5. Launch Missile									
5.1 Lift trigger protective cover									
5.1.1 Unlock trigger protective cover	0	0	1	0	0	0	0	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0	0	0	0	0
5.1.3 Unlocking procedures	0	0	0	0	0	0	0	0	0
5.2 Press firing trigger									
5.2.1 Perform firing procedures	1	1	1	4	3	21	18	21	21
5.2.2 Firing trigger location	1	1	1	4	3	21	18	21	21
5.2.3 Missile firing procedures	1	1	1	4	3	21	15	21	21
6. Track Target Until Missile Impact									
6.1 Make continuous adjustments to keep crosshairs centered on target									

Figure 6-4. TRAINVICE II WORKSHEET: Showing PC and PC_{max} Socres For SHERMAN and PATTON

entire process until the consolidated list is exhausted. To summarize, this sixth and final step of the PC Analysis required the following:

STEP #6

(6.1) Rate each generic characteristic (Figure 6-2, Column VI) as to how well it implements its companion set of good instructional practices (Column III).

(6.2) Sum the ratings from Column VI and enter them in Column VII.

(6.3) Go back to Step #1 of the PC Analysis and repeat the entire process for the next skill, until your consolidated list is exhausted.

SHERMAN-PATTON Comparison

Figure 6 4 shows the PC Analysis for all skills and knowledges related to our hypothetical simulators. Each value was obtained through the procedure described herein. You should notice that skill 2.1.3 (*scanning techniques*) represents the first discrepancy between the two devices. SHERMAN received a PC score of 13 and PATTON received a 21. The difference is because SHERMAN uses a lower fidelity system than PATTON does for training in scanning techniques. Recall that PATTON has the computer generated imagery system which simulates targets on the battlefield, but SHERMAN does

not. You could say that the imagery system is an outstanding PATTON implementation of the physical guidelines for this skill. Therefore, a PC score of 21 is assigned out of a PC_{max} of 21.

In Task 3, where skills 3.1.1 and 3.1.2 were included, notice that SHERMAN received 15 while PATTON scored "0". This was the result of SHERMAN's capability for backblast simulation; PATTON not having such capability. SHERMAN in this case meets the learning guidelines to a high degree while PATTON is extremely deficient in this regard.

The skills under Task 5 (5.2.1, 5.2.2 and 5.2.3) represent other differences between the two types of devices due to the backblast capability difference. It will be of interest to note the ramifications of these differences in the final TRAINVICE II index.

Summary

This concludes the discussion on the Physical Characteristics Analysis. Key points emphasized in this Chapter were:

- Conduct a PC Analysis for every device under consideration.
- Identify the good instructional practices associated with the required skills.
- Identify device elements (i.e., displays, controls, and trainee responses) and their Generic Characteristics associated with the required skills.

- Compare the generic characteristics with the guidelines for good instructional practices and assign each a rating from "0" to "3".
- Calculate a PC_{max} score for each corresponding PC score for each training device.

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6-36

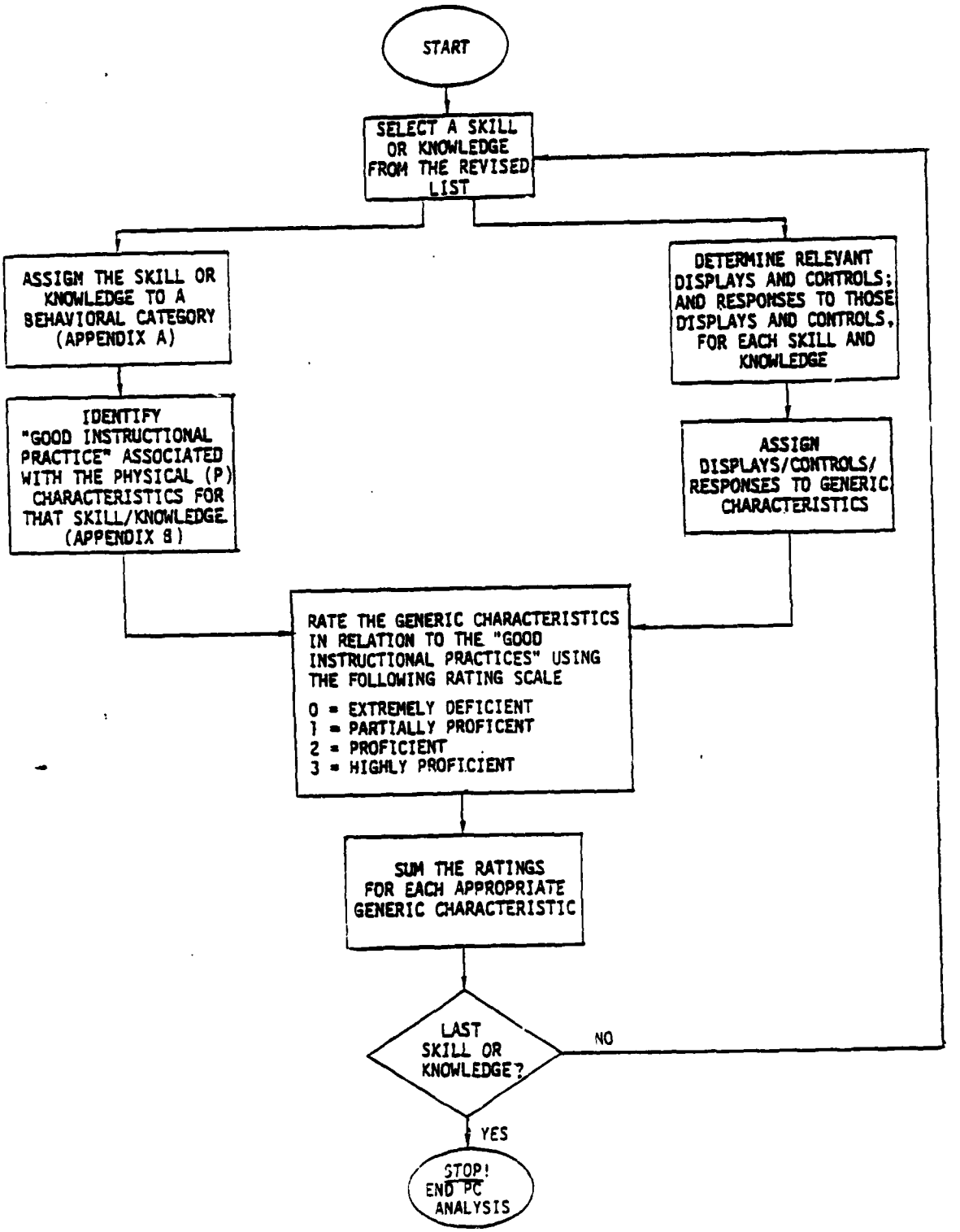

FIGURE 6-1. PHYSICAL CHARACTERISTICS ANALYSIS FLOWCHART

CHAPTER 7

FUNCTIONAL CHARACTERISTICS ANALYSIS

The sixth component of the TRAINVICE II model is the Functional Characteristics (FC) Analysis. This is the second and last of the "device characteristics" analyses; the first was the Physical Characteristics (PC) Analysis. As described in Chapter 6, the PC Analysis assessed how well physical design characteristics of training device "hardware" supported good instructional practices.

The FC Analysis is similar to the PC Analysis in that it assesses how well the use of the functional elements of a training device follow the guidelines for "good instructional practice". As with the PC Analysis, an FC Analysis is completed for each training device being evaluated. A separate worksheet column will therefore be required for each device under consideration.

REMEMBER:

Conduct a separate FC Analysis

for each training device

being evaluated.

Functional Characteristics (FC) Analysis Procedure

Refer to Figure 1-1 of the TRAINVICE II flow chart and locate the FC Analysis in the flow of the model. Note that there are two (2) necessary inputs to the FC Analysis:

(1) The Functional Characteristics Learning Guidelines from the Interservice Procedures for Instructional Systems Development[6] (provided in Appendix B). These are taken from the same set of guidelines used in the PC Analysis.

(2) The Consolidated List of Skills and Knowledges which has been used throughout TRAINVICE II.

The procedure you will follow to calculate the FC Analysis is shown in the foldout Figure 7-1 at the end of this Chapter.

As stated earlier, the objective of the FC Analysis is to determine how well the functional characteristics of a particular training device implement the good instructional practices required to teach a skill or knowledge. To achieve its objective, the FC Analysis compares the capability of each display/control (i.e., how

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[6] U.S. Army, Interservice Procedures for Instructional Systems Development. TRADOC Pam 350-30, U.S. Training and Doctrine Command, Fort Monroe, VA., August 1975.

it functions as a training medium) to the instructional guidelines for the corresponding skill or knowledge (i.e., how those displays/controls should function as training media). The quality of the match between what the displays/controls "can do" vs. "should do" is then assigned a rating, and the analysis is thus complete.

The FC Analysis is, in effect, a continuation of the device characteristics analysis of which the PC Analysis described in Chapter 6 is also a part. In fact, the FC Analysis requires the TRAINVICE II user to simply add three columns to the "PC Analysis Worksheet" introduced in Chapter 6. Hereafter, those three additional columns will be referred to as the FC Analysis Worksheet.

Since the FC Analysis is built upon information developed in the PC Analysis, the user should not attempt the FC Analysis until they have studied the PC Analysis procedure as described in Chapter 6. Once this has been done, it will be evident that the FC Analysis involves an extension of those procedures.

REMEMBER:

Do not attempt the FC Analysis until you have familiarized yourself with the PC Analysis (Chapter 6). The instructions in Chapter 7 assume the user has established this background familiarity.

The steps involved in the FC Analysis are few and rather simple once the user understands the PC Analysis. The FC Analysis does, however, require certain careful judgments; and again, "stepping through" an example will be the best way to explain how this analysis is conducted.

Example of Functional Characteristics (FC) Analysis

In this example of how to conduct the FC Analysis, the fictitious "Sherman" and "Patton" training simulators will be used once again. To aid your recall of these devices and their individual characteristics, a description of each device is repeated here:

- SHERMAN - A simulator with most of the physical characteristics of an anti-armor missile system and having the capability to teach all procedural aspects of system operation and firing at a target. In addition, it is able to simulate the backblast of an actual system. The SHERMAN unit also includes a vehicle light with appropriate switches for tracking targets. SHERMAN does not, however, fire inert missiles and therefore requires an external infrared (IR) target source in order to track targets and record hits or misses.

- PATTON - A simulator very much like SHERMAN with the addition of a computer generated imagery system which simulates targets on a battlefield scene. With PATTON, a trainee can track and "destroy" a target and can be scored on tracking. No external IR source is needed. PATTON does not simulate the backblast of a missile firing. It can, though, be used either in a classroom or in a unit training environment.

In this FC Analysis example, we will analyze the functional characteristics of the SHERMAN system. The same procedures we cover in this example will also apply to the PATTON or to any other comparable device being analyzed. Later in this chapter, you will have a chance to compare the SHERMAN FC Analysis with one for the PATTON. For now, however, we will proceed through the example by analyzing the SHERMAN simulator only.

The baseline information for conducting the FC Analysis has already been established through STEPS 1, 2, and 4 of the PC Analysis (from Chapter 6). This information was recorded on the PC Analysis Worksheet which was presented in Figure 6-2. For convenience, those columns of the worksheet from PC Analysis STEPS 1, 2 and 4 have been reproduced in this chapter as the first part of Figure 7-2.

I	II	IV	VIII	IX	X
SKILL/KNOWLEDGE	BEHAVIORAL CATEGORY	DISPLAY/CONTROL	APPLICABLE FUNCTIONAL GUIDELINES	RATING	FUNCTIONAL CHARACTERISTIC SCORE OVER FC_{max}
1.1.1 Operate Traversing Unit	Performs gross motor skills	Device Traversing Subsystem	3. Present knowledge 4. Present cues 7. Penalty follows 10. Learner demonstrate 11. Provide specific practice 12. Provide varied practice 13. Make objective evident 14. Provide rest 15. Provide distractions 16. Make objective clear 17. Relate learning to tasks 18. Provide feedback 19. Feed comparisons 20. Allow rest 23. Require overlearning 24. Allow individual differences	2 0 0 3 3 3 1 3 2 3 3 0 0 3 2 1	29/48
(From PC ANALYSIS)			FC ANALYSIS		

Figure 7-2

FUNCTIONAL CHARACTERISTICS ANALYSIS WORKSHEET

and

REVELANT COLUMNS FROM THE PC ANALYSIS WORKSHEET

(calculated for SHERMAN simulator)

Refer to Figure 7-2 at this time to locate these three columns. They are labeled columns I, II and IV. The PC Analysis steps to which they correspond are:

STEP #1 (Column I) -- Select a skill/knowledge from the Consolidated List and enter that skill or knowledge in Column I of the PC Analysis Worksheet

STEP #2 (Column II)-- Compare each required skill/knowledge to the ten behavioral categories given in APPENDIX A. Then decide which of those categories best describes the type of "learning" required for the particular skill or knowledge you are considering. Enter the behavioral category you select into Column II of the PC Worksheet, beside the skill/knowledge to which it applies.

STEP #4 (Column IV)-- Determine what displays or controls are used by the training device to teach the required skill or knowledge. Enter a description of the display or control in Column IV of your PC Analysis Worksheet.

Now refer to figure 7-1 (foldout). You will see that these three PC Analysis steps (1, 2 and 4) correspond precisely to the first three steps (uppermost three boxes) shown in the Figure 7-1 flow chart. Therefore, these FC Analysis steps have already been completed in the PC Analysis. Consequently, the FC Analysis will actually begin with the Figure 7-1 element: Identify "good" instructional practices associated with device functional characteristics for the skill/knowledge being considered. (Which is similar to Step #3 in the PC Analysis).

The TRAINVICE II user can see now, that the FC Analysis builds on basic information established in the PC Analysis. Because of this, and since there were seven (7) steps in the PC Analysis, the first step to be discussed of the FC Analysis is similar to PC Analysis Step #3. We will refer to it as Step #8 here. Its corresponding worksheet column will be labeled Column VIII. Note how this is indicated in the second half of Figure 7-2. This approach maintains the spirit of the FC Analysis being an extension of the PC Analysis, and thereby will help simplify explanation greatly. The specific procedure for conducting Step #8 (i.e., the beginning of the FC Analysis) follows.

STEP #8: Identify good instructional practices associated with device functional characteristics, for the skill/ knowledge being considered.

As stated earlier, the first few steps necessary to conducting the FC Analysis are "borrowed" from the PC Analysis. They are represented as Columns I, II, IV in Figure 7-2. These steps involved:

- First, selecting a skill or knowledge from the Consolidated List and entering it into worksheet Column I.
- Second, determining which Behavioral Category in Appendix A best describes the "type of learning" required for the particular skill/knowledge being considered, then recording that behavioral category in Column II of the worksheet.
- Third, identifying the training device's displays/controls used to develop the skill or knowledge being considered. This information was recorded in Column IV of the worksheet.

To initiate the FC Analysis with Step #8, the good instructional practices necessary to teaching the particular skill/knowledge being considered must now be identified for "functional" characteristics. These form the instructional "standard" to which the functional worth of displays and controls will be compared. In our example, we will limit our analysis to the SHERMAN device and the same skills/knowledges used before.

Recall from the PC Analysis that skill 1.1.1, Operate Traversing Unit was judged from APPENDIX A to belong to behavioral category #7, "Performing Gross Motor Skills." In APPENDIX B of this manual, you found an elaboration on each of the ten (10) behavioral categories in terms of "learning guidelines" for good instructional practice. Refer to APPENDIX B, behavioral category #7: Performing Gross Motor Skills, as we proceed.

You will find in Appendix B that behavioral category #7 offers twenty-five (25) guidelines for providing good instruction in performing gross motor skills. Some of these guidelines are preceded by the letter "P"; these apply only to physical aspects of instruction and learning. Others are preceded with the letter "F"; those apply only to functional aspects. Some guidelines are preceded by both letters "P" and "F" and they apply to both physical and functional aspects. Some guidelines simply may not apply at all.

In Step #8, you will use only the behavioral category guidelines preceded by the letter "F" or "P/F". These are the recommended guidelines for good instructional practices regarding functional aspects of training devices.

In behavioral category #7 of APPENDIX B, note that there are ten "F" and thirteen "P/F" guidelines. As rule-of-thumb, expect that all functional guidelines (F's and P/F's) will likely apply to the general type of training device you are evaluating. However, remember too that for some types of devices, certain guidelines found within a behavioral category might not be applicable. In fact, if the device you are analyzing is complex, then judging which "good instructional practice" guidelines are to be included can be a complicated job. In this regard, it may be necessary to consult with experts, manufacturers, colleagues, etc., to assure that your judgements are accurate.

Carefully review each "F" and "P/F" guideline in behavioral category #7 (APPENDIX B) for skill 1.1.1, Operate the Traversing Unit until you have covered all twenty-three (23) functional characteristics guidelines listed there. When you have finished, you should have selected all of those that you believe apply to the skill/knowledge being considered. In the case of required skill 1.1.1, Operate Traversing Unit, the functional characteristics guidelines selected for gross motor skills instruction from APPENDIX B are listed below. Each is stated in abbreviated form for notational convenience:

P/F (3) present early knowledge of results

P/F (4) present external cues early

P/F (7) penalty follows incorrect response

P/F (10) learner can demonstrate task

P/F (11) provide for practice on specific components

P/F (12) provide for practice under varied conditions

P/F (13) Make evident objective and model performance during practice period

P/F (14) provide short rest periods between practice periods

P/F (15) provide real-life distractions, etc., as encountered on-the-job

F (16) early in training, make learning objective clear

F (17) relate learning to operational tasks

F (18) provide student with feedback on right/wrong behaviors

F (19) feedback to student critical comparisons

F (20) allow for rest pauses

F (23) require student to overlearn material

F (24) allow for individual differences

This list of sixteen (16) guidelines now represents ways in which good instruction could be implemented functionally by a device in order to teach skill 1.1.1 Operate Traversing Unit. In effect, it is the instructional "standard" for the functional worth of a device's displays/controls regarding the particular skill/knowledge being considered. Each device's displays and controls will thus be compared to this same standard. This is the same approach used in the PC Analysis. Some of the guidelines selected (above) were also used in the PC Analysis due to their dual "P/F" nature. Nonetheless, they are included here as if never used in the prior analysis. Also, a number of guidelines were discarded as being non-applicable to the FC Analysis for skill 1.1.1, These were guidelines 5,6,8,9,21,22, and 25.

The last phase of Step #3 of the FC Analysis is simply to enter these learning guidelines identified into Column VIII of your FC Worksheet (See Figure 7-2). Write them in abbreviated form or enter their "numerical" code into the worksheet Column VIII as seen in Figure 7-2. Whether you use abbreviated statements or numerics for recording the guidelines, Step #8 is completed once you record them in worksheet Column VIII beside the required skill/knowledge they

address. To review this step before proceeding, Step #3 required you to do the following:

STEP #8

8.1 For the required skill/knowledge, locate its behavioral category in APPENDIX B.

8.2 Under the behavioral category located in APPENDIX B, study the learning guidelines for "good instructional practice" associated with functional characteristics (F or P/F). Select those learning guidelines appropriate to the type of device you are analyzing (most should apply).

8.3 In Column VIII of the FC Worksheet, record the learning guidelines you selected, beside the skill/knowledge to which they correspond (use abbreviated statements or numeric codes).

STEP # 9: Rate How Well the Display/Control Implements The Functional Guidelines for Good Instructional Practice.

In the previous step of the FC Analysis example, we determined what "good instructional practices" were required to teach the skill 1.1.1, Operate Traversing Unit for SHERMAN. Now, we will evaluate how well the displays and controls actually do the functional job. In Step #9, this is accomplished as follows.

You must rate how well the SHERMAN (or PATTON, etc.) displays/controls can be expected to implement each of the good instructional practices associated with a particular skill/knowledge. For example, you would rate how well the Device Traversing Subsystem (Figure 7-2, Column IV) measures up to implementing each of the good instructional practice guidelines (found in Step #8) for teaching skill area 1.1.1, Operate Traversing Unit. This approach differs from that used in the PC Analysis. In the PC Analysis, a summary rating was assigned to each generic characteristic of the display/control. In the FC Analysis, however, a rating must be assigned to each applicable guideline for the particular display/control. This is shown completed in Figure 7-2, Column IX; the rating scale is as follows:

0 = Extremely deficient implementation of guidelines (or) no implementation at all.

1 = Partially proficient implementation of guidelines; at least minimal implementation is achieved.

2 = Proficient implementation of guidelines; implementation is adequate to good in quality.

3 = Highly proficient implementation of guidelines; implementation is of high exceptional quality (or) identical with guidelines.

The rating scale is used as before to indicate your best judgement regarding how well the particular display/control (from Figure 7-2 Column IV) implements each instructional practice guideline in Column VIII. Again, consultation with colleagues, experts, etc. is advised in making your judgement. The ratings of how well the particular display/control implements the guidelines is entered in Column IX, alongside each guideline to which it pertains (Column VIII). This is shown completed for SHERMAN in the FC Analysis worksheet, Figure 7-2. Note in Figure 7-2 that the Device Traversing Subsystem for SHERMAN was not judged (in Column IX) to implement each of the guidelines equally well.

Remember, too that when no display/control is present to support the guidelines (i.e., as determined from the C Analysis) the term NONE will be entered in Column IV, and FC scores assigned to the device would be "zero". This is the same procedure described for the PC Analysis. To summarize Step #9, the following was required:

STEP #9

9.1 Rate the display or control (Figure 7-2) Column IV) as to how well it implements its companion set of good instructional practices (Column VIII) for functional characteristics.

9.2 Enter these ratings in Column IX, beside the corresponding instructional practice guideline to which each applies.

STEP #10: Sum the Guideline Ratings for Each Skill/Knowledge.

The final phase of the FC Analysis produces a "sum" of the ratings given in Step #5. This sum is then entered into Column X of the FC Worksheet as shown in Figure 7-2. Recall from the PC Analysis that the maximum number of points that the display/control could attain is also calculated and recorded. In the FC Analysis this maximum is termed the "FC_{max}" score. Note in Figure 7-2, Column X, that the FC score of 29 has been recorded over the FC_{max} of 48. The FC_{max} is essential to final TRAINVICE II index calculations and will be recorded in its own column in the TRAINVICE II Master Worksheet (see Figure 7-3). The FC_{max} score is calculated as follows:

ALWAYS CALCULATE AND RECORD EACH FC_{max} SCORE FOR ITS CORRESPONDING FC SCORE

FC_{max} = The total number of Applicable Functional Guidelines in Column VIII X The highest possible rating, which is always "3"

In the SHERMAN example illustrated in Figure 7-2, sixteen (16) guidelines were applicable to the Device Traversing Subsystem used to teach Skill 1.1.1; therefore, the maximum number of points (FC_{max}) which could have been awarded to the Device Traversing Subsystem was forty-eight (16 x 3 = 48).

Once the FC/FC_{max} scores are entered in Column X, the FC Analysis for Skill 1.1.1 is complete, and the entire procedure is recycled for the next skill/knowledge. To summarize, Step #10 required:

STEP #10

10.1 Sum the ratings in Column IX and enter the sum in Column X as a ratio of the POINTS EARNED/ POINTS POSSIBLE (i.e., FC Score/FC_{max}).

10.2 Go back to Step #8 (first step of the FC Analysis) and repeat the entire procedure for the next skill/ knowledge, until your Consolidated List is exhausted.

SHERMAN - PATTON Comparison

Figure 7-3 shows the FC Analysis for all the skills and knowledges of our hypothetical simulators. Each value was obtained exactly as in the procedure described in this chapter. You should note that skill 1.1.1, Operate Traversing Unit, represents a major discrepancy between the two devices. Apparently, SHERMAN has the more capable functioning displays/controls and therefore was assigned the greater score.

The functional capability which corresponds to skill 2.1.3 Scanning Techniques, was rated a 12 out of a possible 18 for SHERMAN. Here, PATTON received the maximum score (18 out of a possible 18). The reason for this difference is that SHERMAN uses a different system for training tasks involving scanning than does PATTON. Remember PATTON has the computer generated imagery system which simulates targets on the battlefield, but SHERMAN does not. The SHERMAN system was therefore rated lower in functional characteristics. The imagery system on PATTON represents an outstanding implementation of the guidelines.

For skills 3.1.1 and 3.1.2, SHERMAN received a rating and PATTON did not. The reason for this is simply that PATTON is extremely deficient in the elements (displays or controls) associated with these required skills. Obviously, the zero rating will not eliminate PATTON from consideration, but this deficit will serve to lower its overall TRAINVICE II index. Conversely, the superior rating given to SHERMAN was due to its backblast simulation capability.

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS	SHERMAN PHYSICAL CHARACTERISTIC SCORE	PATTON PHYSICAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE PC SCORE	PATTON MAXIMUM POSSIBLE PC SCORE	SHERMAN FUNCTIONAL CHARACTERISTIC SCORE	PATTON FUNCTIONAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE FC SCORE	PATTON MAXIMUM POSSIBLE FC SCORE
1. Load the Launch Tube	CR	C	C	P	D	PC	PC	PC_{max}	PC_{max}	FC	FC	FC_{max}	FC_{max}
1.1 Lock traversing unit in azimuth and elevation													
1.1.1 Operate traversing unit	1	1	1	3	3	18	18	18	18	29	13	48	15
1.1.2 Azimuth and elevation movement	1	1	1	3	3	15	15	15	15	14	15	15	15
1.1.3 Locking mechanism	1	1	1	3	3	15	15	15	15	15	14	18	15
1.2 Remove encased missile from stowed position													
1.2.1 Remove casing materials from missile	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0	0	0	0	0	0	0	0	0.
1.3 Load encased missile													
1.3.1 Loading procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.2 Locking procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.4 Loading and locking mechanisms	1	1	1	4	2	18	18	18	18	15	15	15	15
2. Select a Target													
2.1 Visually select target													
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2	13	21	21	21	12	18	18	18
2.2 Swing traversing unit to align optical sight													
2.2.1 Unlocking procedures	1	1	1	4	3	18	18	18	18	15	15	18	18
3. Connect Encased Missile													
3.1 Insure personnel are clear of firing danger zone													
3.1.1 Monitoring danger area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.1.2 Danger zone area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.2 Raise aiming lever													
3.2.1 Operating aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
3.2.2 Position and function of aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
4. Acquire and Track Target													
4.1 Turn on and adjust vehicle light if needed													
4.1.1 Operation of light switch	0	1	0	0	0	0	0	0	0	0	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3	0	0	0	0	0	0	0	0
4.2 Operate focus control													
4.2.1 Perform focusing procedures	1	1	1	3	2	18	18	18	18	15	15	15	15
4.2.2 Locate focus control	1	1	1	3	1	18	18	18	18	15	15	15	15
4.2.3 Focusing control operation	1	1	1	3	1	18	18	18	18	15	15	15	15
4.3 Operate traversing sight													
4.3.1 Perform traversing movement	1	1	1	3	2	18	18	18	18	18	18	18	18
4.3.2 Traversing sight location	1	1	1	3	1	18	18	18	18	18	18	18	18
4.3.3 Traversing sight procedures	1	1	1	3	1	18	18	18	18	18	18	18	18
4.4 Operate optical sight													
4.4.1 Perform SOP for optical sighting	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Launch Missile													
5.1 Lift trigger protective cover													
5.1.1 Unlock trigger protective cover	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.3 Unlocking procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5.2 Press firing trigger													
5.2.1 Perform firing procedures	1	1	1	4	3	21	18	21	21	24	18	24	21
5.2.2 Firing trigger location	1	1	1	4	3	21	18	21	21	24	18	24	24
5.2.3 Missile firing procedures	1	1	1	4	3	21	15	21	21	24	15	24	24
6. Track Target Until Missile Impact													
6.1 Make continuous adjustments to keep crosshairs centered on target													

Therefore, as regards these skills, SHERMAN addresses the functional guidelines at an outstanding level. Skills 5.2.1., 5.2.2, and 5.2.3 received FC scores which also reflect the difference in the backblast simulation capability.

Summary

Key points emphasized in the Chapter were:

- Conduct a separate FC Analysis for each training device being evaluated
- The inputs for the FC Analysis are the ISD Guidelines and the Consolidated List of skills and knowledges
- Each ISD Guideline is consulted to identify those applicable to functional characteristics of device elements
- Rate each display/control-on-their associated guidelines using a criteria scale of 0 to 3, as was done in the PC Analysis
- Calculate an FC_{max} score for each corresponding FC score for each training device.

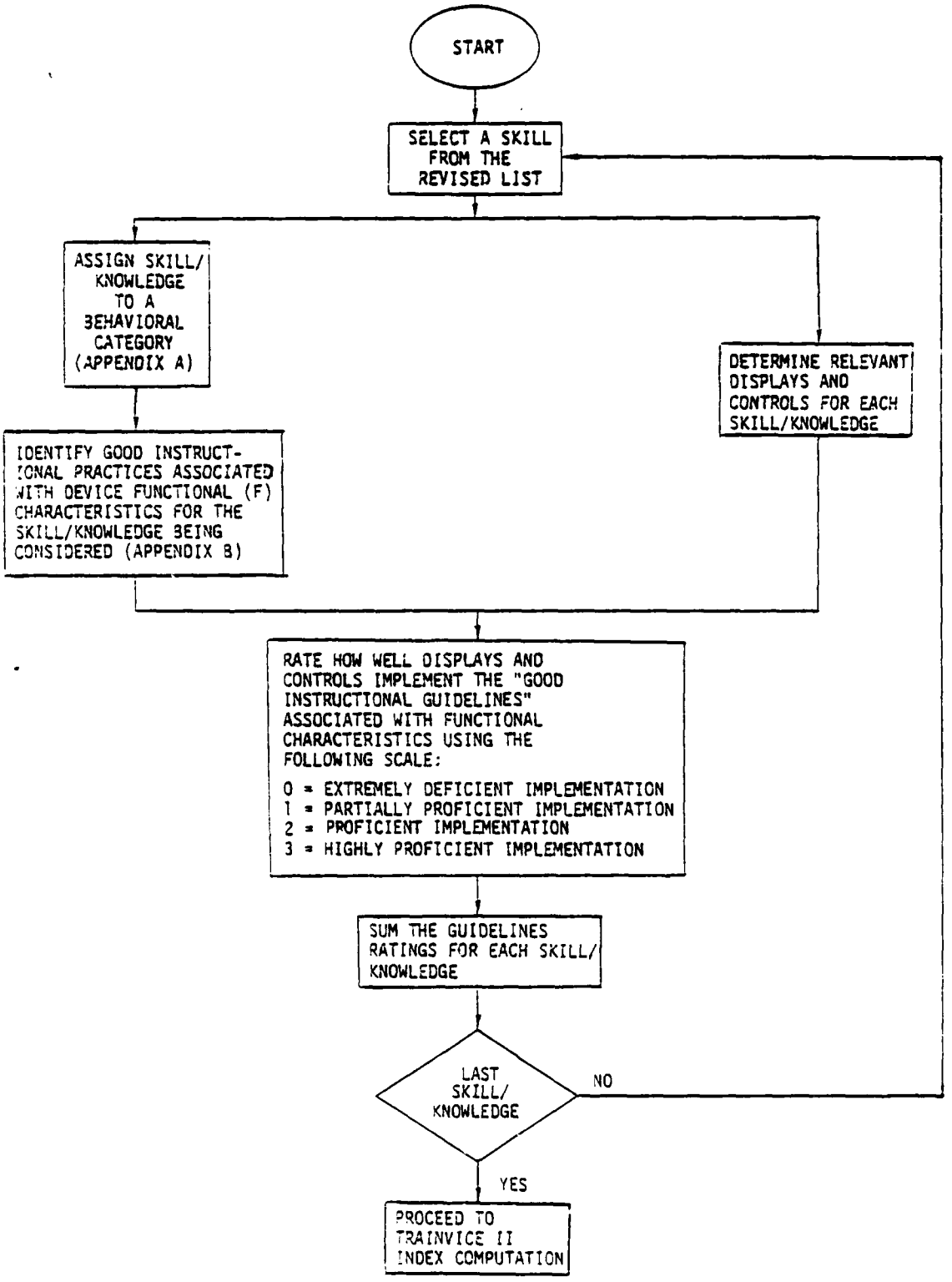

FIGURE 7-1. FUNCTIONAL CHARACTERISTICS ANALYSIS FLOWCHART

CHAPTER 8

TRAINVICE II COMPUTATION

The last step in the TRAINVICE II model is the TRAINVICE II INDEX (TI) calculation. The TI is used to determine how well a training device prepares an individual for an operational setting. Functioning proficiently in an operational setting as a result of adequate training is termed transfer of training. Thus, the primary purpose of the TI is to assess transfer of training. In its calculations, the TI assumes that if a device were to follow perfectly all necessary instructional guidelines, maximum training transfer would result. Therefore, a calculated "maximum score" is used as a computed baseline against which a particular training device's score will be compared.

TRAINVICE II INDEX CALCULATION

To calculate the TRAINVICE II INDEX (TI), the formula in Equation 8.1 is used:

$$TI = \frac{\sum\left(\frac{PC + FC}{PC_{max} + FC_{max}}\right)\left(C \times P \times D\right)}{\sum\left(P \times D\right)}$$

Equation 8.1 - TRAINVICE II INDEX

WHERE:

- TI = TRAINVICE II INDEX (final score) for the particular training device being analyzed
- $\sum$ = Sum of (accumulation)
- PC = Physical Characteristics score
- FC = Functional Characteristics score
- PC_{max} = Maximum possible Physical Characteristics score
- FC_{max} = Maximum possible Functional Characteristics score
- C = Coverage Analysis score
- P = Proficiency score
- D = Difficulty score

You will note in Equation 8.1 that the "ratio" of the sum of the PC and FC score to the sum of the PC_{max} and FC_{max} score is a key element in calculating the TI. The PC and FC scores are, of course, taken directly from the PC Analysis and FC Analysis for the particular device being analyzed. PC_{max} and FC_{max} scores, as described in Chapters 6 and 7, are projected maximum scores for the device. Because of the importance of these maximum scores in computing the TI, their concepts from Chapters 6 and 7 will be briefly reviewed here.

The PC_{max} score is calculated for each skill or knowledge in the analysis. The PC_{max} score is determined by multiplying the total number of applicable generic characteristics for a particular skill/knowledge by the maximum rating value each characteristic could receive. If all of the possible generic characteristics were applicable to a particular skill/knowledge, there would be seven (7) generic characteristics employed in its PC Analysis. Since the highest rating value any one of those characteristics could receive is "3", the PC_{max} score for the skill or knowledge would be 21 (i.e., 7 x 3). Of course, less than seven generic characteristics might apply to a particular skill/knowledge of a device and thus it is common to have a PC_{max} score of less than 21 (e.g., see Chapter 6, Figure 6-2, Column VII).

FOR ANY ONE SKILL OR KNOWLEDGE:
PC_{MAX} = [No. of applicable generic characteristics] X ["3"]

To calculate the FC_{max} score a similar procedure is followed. For the particular skill or knowledge being considered, the <u>total number of good instructional practice guidelines</u> (from APPENDIX B) is first identified. This number is then multiplied by the <u>maximum rating value</u> any guideline could receive. This maximum rating value will always be "3". Therefore, the FC_{max} score for a particular skill/knowledge of the device being analyzed can be expressed as follows:

FOR ANY ONE SKILL OR KNOWLEDGE

$$FC_{MAX} = \left[\begin{array}{c}\text{No. of applicable} \\ \text{good instructional} \\ \text{practice guidelines}\end{array}\right] \quad X \quad \left[\text{"3"}\right]$$

Because the number of good instructional practice guidelines will vary according to their behavioral category and applicability to a specific skill/knowledge of a device, the FC_{max} score will also vary accordingly (e.g., see Chapter 7, Figure 7-2, Column X).

The $\left[PC + FC\right] / \left[PC_{max} + FC_{max}\right]$ ratio for each skill or knowledge is weighted (multiplied) by the corresponding Coverage (C) Analysis score, the Proficiency (P) score and the Difficulty (D) score. Note from equation 8.1 that a "0" score from the Coverage (C) Analysis

will cause the entire upper part of the equation to be equal to zero. This is because any value multiplied by a value of zero yields "zero". The lower part of the equation, however, will not change. This process will assure that the overall TI score of a device is penalized when the device fails to provide for specific requirements of a particular skill or knowledge. When C = 1, however, the weighting of the device characteristics ratio by the Proficiency (P) and Difficulty (D) scores permits the more important skills and knowledges to influence the overall index to a greater extent than the less important skills and knowledges.

As stated above, the Coverage Analysis score weights the device characteristics ratio in such a way as to penalize a device for failing to provide for a required skill or knowledge. Note the scoring, however; For Task 4.1 in Figure 8-1, no penalty is given to a device which includes more elements than necessary (as did the SHERMAN). Simply, "zeros" are assigned in final calculation for that particular skill or knowledge as with any unrequired skill/knowledge. The reason no penalty is given is because the user cannot freely assume that the representation of unnecessary skills in a device will equate with disruption of training or hinder its transfer. Nor can one conclude that providing training for an unrequired skill or knowledge represents an advantage. The TI calculation process, therefore, simply produces a neutral score in these cases. This also applies to situations where the CR score is "zero" and the C score is also "zero".

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS	SHERMAN PHYSICAL CHARACTERISTIC SCORE	PATTON PHYSICAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE PC SCORE	PATTON MAXIMUM POSSIBLE PC SCORE	SHERMAN FUNCTIONAL CHARACTERISTIC SCORE	PATTON FUNCTIONAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE FC SCORE	PATTON MAXIMUM POSSIBLE FC SCORE
1 Load the launch tube	CR	C	C	P	D	PC	PC	PC_{max}	PC_{max}	FC	FC	FC_{max}	FC_{max}
1.1 Lock traversing unit in azimuth and elevation													
1.1.1 Operate traversing unit	1	1	1	3	3	18	18	18	18	29	13	48	15
1.1.2 Azimuth and elevation movement	1	1	1	3	3	15	15	15	15	14	15	15	15
1.1.3 Locking mechanism	1	1	1	3	3	15	15	15	15	15	14	18	15
1.2 Remove encased missile from stowed position													
1.2.1 Remove casing materials from missile	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3 Load encased missile													
1.3.1 Loading procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.2 Locking procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.4 Loading and locking mechanisms	1	1	1	4	2	18	18	18	18	16	15	15	15
2 Select a target													
2.1 Visually select target													
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2	13	21	21	21	12	18	18	18
2.2 Swing traversing unit to align optical sight													
2.2.1 Unlocking procedures	1	1	1	4	3	18	18	18	18	15	15	18	18
3 Connect Encased Missile													
3.1 Insure personnel are clear of firing danger zone													
3.1.1 Monitoring danger area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.1.2 Danger zone area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.2 Raise aiming lever													
3.2.1 Operating aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
3.2.2 Position and function of aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
4 Acquire and track target													
4.1 Turn on and adjust vehicle light if needed													
4.1.1 Operation of light switch	0	1	0	0	0	0	0	0	0	0	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3	0	0	0	0	0	0	0	0
4.2 Operate focus control													
4.2.1 Perform focusing procedures	1	1	1	3	2	18	18	18	18	15	15	15	15
4.2.2 Locate focus control	1	1	1	3	1	18	18	18	18	15	15	15	15
4.2.3 Focusing control operation	1	1	1	3	1	18	18	18	18	15	15	15	15
4.3 Operate traversing sight													
4.3.1 Perform traversing movement	1	1	1	3	2	18	18	18	18	18	18	18	18
4.3.2 Traversing sight location	1	1	1	3	1	18	18	18	18	18	18	18	18
4.3.3 Traversing sight procedures	1	1	1	3	1	18	18	18	18	18	18	18	18
4.4 Operate optical sight													
4.4.1 Perform SOP for optical sighting	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Launch Missile													
5.1 Lift trigger protective cover													
5.1.1 Unlock trigger protective cover	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.3 Unlocking procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5.2 Pre s firing trigger													
5.2 Perform firing procedures	1	1	1	4	3	21	18	21	21	24	18	24	21
5.2.2 Firing trigger location	1	1	1	4	3	21	18	21	21	24	18	24	24
5.2.3 Missile firing procedures	1	1	1	4	3	21	15	21	21	24	15	24	24
6 Track Target Until Missile Impact													
6.1 Make continuous adjustments to keep crosshairs centered on target													

One might well ask, at this point, why unrequired skills and knowledges are not dropped from the original Consolidated List once they receive a Coverage Requirements (CR) score of "zero". After all, why not consider dropping from the list those skills/knowledges not required in a training device? There are at least two reasons the analyst keeps skills/knowledges in the analysis if they are not required (i.e., CR = 0). First, the analyst may identify skills being represented in training devices that point out a task requirement overlooked in preparing the Consolidated List. Second, the analyst may identify unnecessary skills covered by the training device(s) and can offer feedback on their presence to designers/manufacturers. The inclusion of "CR = 0" skills in the Consolidated List is thus done to assure thorough accountability in analysis. An example of such superfluous inclusions is shown in Figure 8-1 under task areas 1.2, 2.1, 4.1, 4.4, and 5.1.

After all of the TRAINVICE II calculations have been made, the final TI value will lie between "0" and "1". As the TI value approaches 1, the better the training transfer capability of a device. Recognize that in comparing two or more devices, you will actually be comparing their TI's. The highest TI represents the better transfer of training opportunity, all other things held equal.

REMEMBER:
After all the calculations are completed, the final TI value will lie between 0 and 1; where a score of "1" is the highest attainable TI score

EXAMPLE TI CALCULATION

Once a training device's scores for each of the six TRAINVICE II components have been determined and entered on the TRAINVICE II master worksheet, the user can proceed with the calculation of the TI. Tables 8-1 and 8-2 show all values needed to calculate the TI for SHERMAN and PATTON. Note in Figure 8-1 the columns displaying the PC_{max} and FC_{max} scores for each device. This maximum (or) "ideal" score has been calculated there for each skill and knowledge. Figure 8-1 also shows that only skills and knowledges having a Coverage Requirements (CR) score of "1" are calculated, since skills and knowledges not necessary for instruction will only receive final scores of zero (e.g., see task 1.2 in the Figure).

The particular device's final TI is simply an accumulation (sum) of its individual TI's calculated for each skill or knowledge. Calculation of the TI for a single skill or knowledge (call it the "TI_{skill}")

SKILL	TI		CUMULATIVE TI
1.1.1	$\frac{(\frac{18+29}{18+48})(1\times3\times3)}{3\times3}$	$= \frac{6.41}{9}$	$\frac{6.41}{9}$
1.1.2	$\frac{(\frac{15+14}{15+15})(1\times3\times3)}{3\times3}$	$= \frac{8.70}{9}$	$\frac{15.11}{18}$
1.1.3	$\frac{(\frac{15+15}{15+18})(1\times3\times4)}{3\times3}$	$= \frac{10.91}{9}$	$\frac{26.02}{27}$
1.3.1	$\frac{(\frac{18+15}{18+15})(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{34.02}{35}$
1.3.2	$\frac{(\frac{18+15}{18+15})(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{42.02}{43}$
1.3.3	$\frac{(\frac{18+15}{18+15})(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{50.02}{51}$
1.3.4	$\frac{(\frac{18+15}{18+15})(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{58.02}{59}$
2.1.3	$\frac{(\frac{13+12}{21+18})(1\times4\times2)}{4\times2}$	$= \frac{5.13}{8}$	$\frac{63.15}{67}$
2.2.1	$\frac{(\frac{18+15}{18+18})(1\times4\times3)}{4\times3}$	$= \frac{11.00}{12}$	$\frac{74.15}{79}$
3.1.1	$\frac{(\frac{15+15}{15+15})(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{80.15}{85}$
3.1.2	$\frac{(\frac{15+15}{15+15})(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{86.15}{91}$
3.2.1	$\frac{(\frac{18+18}{18+21})(1\times3\times3)}{3\times3}$	$= \frac{8.31}{9}$	$\frac{94.46}{100}$
3.2.2	$\frac{(\frac{18+18}{18+21})(1\times3\times3)}{3\times3}$	$= \frac{8.31}{9}$	$\frac{102.77}{109}$
4.2.1	$\frac{(\frac{18+15}{18+15})(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{108.77}{115}$
4.2.2	$\frac{(\frac{18+15}{18+15})(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{111.77}{118}$
4.2.3	$\frac{(\frac{18+15}{18+15})(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{114.77}{121}$
4.3.1	$\frac{(\frac{18+18}{18+18})(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{120.77}{127}$
4.3.2	$\frac{(\frac{18+18}{18+18})(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{123.77}{130}$
4.3.3	$\frac{(\frac{18+18}{18+18})(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{126.77}{133}$
5.2.1	$\frac{(\frac{21+24}{21+24})(1\times4\times3)}{4\times3}$	$= \frac{12}{12}$	$\frac{138.77}{145}$
5.2.2	$\frac{(\frac{21+24}{21+24})(1\times4\times3)}{4\times3}$	$= \frac{12}{12}$	$\frac{150.77}{157}$
5.2.3	$\frac{(\frac{21+24}{21+24})(1\times4\times3)}{4\times3}$	$= \frac{12}{12}$	$\frac{162.77}{169} = .963$

THEREFORE

$$\frac{\sum\left(\frac{PC+FC}{PC_{max}+FC_{max}}\right)\left(C\times C_i\times D\right)}{\sum\left(C_i\times D\right)} = .963 = .96$$

Table 8-1. TI COMPUTATION FOR SHERMAN

SKILL	TI		CUMULATIVE TI
1.1.1	$\frac{\left(\frac{18+13}{18+15}\right)(1x3x3)}{3 \times 3}$	$= \frac{3.46}{9}$	$\frac{3.46}{9}$
1.1.2	$\frac{\left(\frac{15+15}{15+15}\right)(1x3x3)}{3 \times 3}$	$= \frac{9}{9}$	$\frac{17.46}{18}$
1.1.3	$\frac{\left(\frac{15+14}{15+15}\right)(1x3x3)}{3 \times 3}$	$= \frac{8.7}{9}$	$\frac{26.16}{27}$
1.3.1	$\frac{\left(\frac{18+15}{18+15}\right)(1x4x2)}{4 \times 2}$	$= \frac{8}{8}$	$\frac{34.16}{35}$
1.3.2	$\frac{\left(\frac{18+15}{18+15}\right)(1x4x2)}{4 \times 2}$	$= \frac{8}{8}$	$\frac{42.16}{43}$
1.3.3	$\frac{\left(\frac{18+15}{18+15}\right)(1x4x2)}{4 \times 2}$	$= \frac{8}{8}$	$\frac{50.16}{51}$
1.3.4	$\frac{\left(\frac{18+15}{18+15}\right)(1x4x2)}{4 \times 2}$	$= \frac{8}{8}$	$\frac{58.16}{59}$
2.1.3	$\frac{\left(\frac{21+18}{21+18}\right)(1x4x2)}{4 \times 2}$	$= \frac{8}{8}$	$\frac{66.15}{67}$
2.2.1	$\frac{\left(\frac{18+15}{18+18}\right)(1x4x3)}{4 \times 3}$	$= \frac{11}{12}$	$\frac{77.16}{79}$
3.1.1	$\frac{\left(\frac{0+0}{15+15}\right)(1x3x2)}{3 \times 2}$	$= \frac{0}{6}$	$\frac{77.16}{85}$
3.1.2	$\frac{\left(\frac{0+0}{15+15}\right)(1x3x2)}{3 \times 2}$	$= \frac{0}{6}$	$\frac{77.16}{91}$
3.2.1	$\frac{\left(\frac{18+18}{18+21}\right)(1x3x3)}{3 \times 3}$	$= \frac{8.31}{9}$	$\frac{85.47}{100}$
3.2.2	$\frac{\left(\frac{18+18}{18+21}\right)(1x3x3)}{3 \times 2}$	$= \frac{8.31}{9}$	$\frac{93.78}{109}$
4.2.1	$\frac{\left(\frac{18+15}{18+15}\right)(1x3x2)}{3 \times 2}$	$= \frac{6}{6}$	$\frac{99.78}{115}$
4.2.2	$\frac{\left(\frac{18+15}{18+15}\right)(1x3x1)}{3 \times 1}$	$= \frac{3}{3}$	$\frac{102.78}{118}$
4.2.3	$\frac{\left(\frac{18+15}{18+15}\right)(1x3x1)}{3 \times 1}$	$= \frac{3}{3}$	$\frac{105.78}{121}$
4.3.1	$\frac{\left(\frac{18+18}{18+18}\right)(1x3x2)}{3 \times 2}$	$= \frac{6}{6}$	$\frac{111.78}{127}$
4.3.2	$\frac{\left(\frac{18+18}{18+18}\right)(1x3x1)}{3 \times 1}$	$= \frac{3}{3}$	$\frac{114.78}{130}$
4.3.3	$\frac{\left(\frac{18+18}{18+18}\right)(1x3x1)}{3 \times 1}$	$= \frac{3}{3}$	$\frac{117.78}{133}$
5.2.1	$\frac{\left(\frac{18+18}{21+21}\right)(1x4x3)}{4 \times 3}$	$= \frac{10.29}{12}$	$\frac{128.07}{145}$
5.2.2	$\frac{\left(\frac{18+18}{21+24}\right)(1x4x3)}{4 \times 3}$	$= \frac{9.6}{12}$	$\frac{137.67}{157}$
5.2.3	$\frac{\left(\frac{15+15}{21+24}\right)(1x4x3)}{4 \times 3}$	$= \frac{8.0}{12}$	$\frac{145.67}{169} = .364$

THEREFORE

$$\frac{\sum\left(\frac{PC + FC}{PC_{max} + FC_{max}}\right)(C \times C_i \times 0)}{\sum(C_i \times 0)} = .364 = .36$$

Table 8-2. TI COMPUTATION FOR PATTON

is shown in Equation 8.2. It differs only from Equation 8.1 in that there are no summation signs $\left(\sum\right)$ present.

$$TI_{(skill)} = \frac{\left(\frac{PC + FC}{PC_{max} + FC_{max}}\right)\left(C \times P \times D\right)}{(P \times D)}$$

Equation 8.2 - TI Computation for a Single Skill or Knowledge

We begin our calculation of the final TI by first calculating the $TI_{(skill)}$ for <u>each</u> individual skill and knowledge. For the first skill <u>1.1.1, Operate Traversing Unit</u>, the following values are taken from Figure 8-1 for SHERMAN:

(CR)	Coverage Requirement	= 1
(C)	Coverage Analysis	= 1
(P)	Training Proficiency	= 3
(D)	Learning Difficulty	= 3
(PC)	Physical Characteristics	= 18 out of (P_{max}) 18
(FC)	Functional Characteristics	= 29 out of (F_{max}) 48

We will now substitute the above values in the TI (skill) formula (i.e., equation 8.3):

$$TI_{(\text{skill } 1.1.1)} = \frac{\left(\frac{18 + 29}{18 + 48}\right)\left(1x3x3\right)}{3 \times 3} \quad \text{Equation 8.3}$$

$$= \frac{\left(\frac{47}{66}\right)\left(9\right)}{9} \quad \text{Equation 8.4}$$

$$= \frac{(.712)\ (9)}{9} \quad \text{Equation 8.5}$$

$$= \frac{6.41}{9} \quad \text{Equation 8.6}$$

The $TI_{(\text{skill } 1.1.1)}$ calculation is complete at Equation 8.6. To continue on toward computation of the final TI (i.e., the final overall score for the device), the user selects the next skill (in this case 1.1.2) and substitutes its values into Equation 8.2. This process is repeated over and over for the remaining skills/knowledges on the Consolidated List until the list is exhausted. For the moment, however, we will address some important points regarding Equations 8.3 - 8.6 before computing the final TI.

Notice in equation 8.3 that the calculations proceed from the inside out. That is, in the upper part of the equation, calculations <u>inside</u> the parentheses "( )" are completed first. All operations in the lower part of the equation are straightforward. In calculating the TI, equation 8.6 is the terminal calculation for a single skill or knowledge. Subsequent skills and knowledges will also be calculated in the same manner to this point. Then,

each of these equations from Equation 8.6 will be added together (i.e., accumulated or summed). It is most important to point out that the equations will NOT be summed by the usual rules of mathematics. Specifically, addition through the use of a "common denominator" will not apply. Rather, all upper portions of the equations are summed for the skills and knowledges independent of the lower part. Then, all lower portions of the equations are summed, likewise independent of the upper part. A "common denominator" is, thus, not employed.

REMEMBER:
To calculate the final TRAINVICE II INDEX (TI), first sum all $TI_{(skill)}$ upper portions independent of the lower portions; then sum all lower portions. A "common denominator", therefore, is NOT employed. The final TI can, thus, be expressed as: $$TI_{final} = \frac{\sum(TI_{skill}\text{ upper parts})}{\sum(TI_{skill}\text{ lower parts})}$$

As a final comment on the calculation of Equations 8.3 - 8.6, all decimals are rounded to "two" places. This rounding rule was applied consistently to all calculations shown in the examples in this chapter.

We will now proceed with calculation of the $TI_{(skill)}$ for the next skill 1.1.2, Azimuth and Elevation Movement. The following values are again taken from Figure 8-1 for SHERMAN:

CR = 1

C = 1

P = 3

D = 3

PC = 15 out of (PC_{max}) 15

FC = 14 out of (FC_{max}) 15

Substituting these values in the $TI_{(skill)}$ equation:

$$TI_{(skill\ 1.1.2)} = \frac{\left(\frac{15 + 14}{15 + 15}\right)(1x3x3)}{3 \times 3} \qquad \text{Equation 8.7}$$

$$= \frac{\left(\frac{29}{30}\right)(9)}{9} \qquad \text{Equation 8.8}$$

$$= \frac{(.966)(9)}{9} \qquad \text{Equation 8.9}$$

$$= \frac{8.70}{9} \qquad \text{Equation 8.10}$$

The $TI_{(skill\ 1.1.2)}$ calculations are complete with Equation 8.10. Equation 8.10 can now be added to equation 8.6 as follows toward developing the final TRAINVICE II INDEX:

Equation 8.6	Equation 8.10	8.6	(8.10)	Cumulative TI
$TI_{(1.1.1)}$ +	$TI_{(1.1.2)}$ =	$\frac{6.41}{9}$ (+) (+)	$\frac{8.70}{9}$ =	$\frac{15.11}{18}$

Note how the upper and lower portions of the equations in the above example are summed independent of one another to produce the Cumulative TI. The principle of "common denominators" is NOT used in TRAINVICE II INDEX calculations. Calculations should thus continue in the same manner for each skill and knowledge. Table 8.1 shows the entire TI calculation completed for SHERMAN. Table 8.2 shows the TI calculation likewise completed for PATTON. The final TRAINVICE II INDEX for SHERMAN is .96 (see Table 8.1) and for PATTON is .86 (see Table 8.2). The obvious interpretation is that the SHERMAN simulator, when compared to PATTON, provides for slightly better transfer of training. This is all that can be said of the devices based on the outcome of the TRAINVICE II index (TI). The TI is simply a tool for ordering training devices in terms of transfer of training capability.

FINAL DISCUSSION

The user should now realize that decisions made earlier in the TRAINVICE II components can have a major impact on calculating the final TI. For example, notice how the P and D scores are used as weights in Equation 8.1 (or) 8.2. If both of these analyses for any one device yielded the maximum possible score (i.e., 4 and 4), a weight of 16 would result. Such a large value corresponding to a skill or knowledge

will have a major influence in the final TI value. To illustrate, consider skill 1.1.1, Operate the Traversing Unit. In the original components the P and D values were each 3. To demonstrate the need for making careful judgements throughout TRAINVICE II components, let's examine some alternative values that could have been used in the P and D analyses. Substituting some of these values for SHERMAN's skill 1.1.1 into Equation 8.2, we get:

$$TI\ (P=1;\ D=1) = \frac{\left(\frac{18+29}{18+48}\right)(1x1x1)}{1x1x1} = \frac{\left(\frac{47}{66}\right)(1)}{1} = \frac{(.712)(1)}{1} = .71$$

$$TI\ (P=2;\ D=2) = \frac{\left(\frac{18+29}{18+48}\right)(1x2x2)}{2x2} = \frac{\left(\frac{47}{66}\right)(4)}{4} = \frac{(.712)(4)}{4} = \frac{2.85}{4}$$

$$TI\ (P=3;\ D=3) = \frac{\left(\frac{18+29}{18+48}\right)(1x3x3)}{3x3} = \frac{\left(\frac{47}{66}\right)(9)}{9} = \frac{(.712)(9)}{9} = \frac{6.41}{9}$$

$$TI\ (P=4;\ D=4) = \frac{\left(\frac{18+29}{18+48}\right)(1x4x4)}{4x4} = \frac{\left(\frac{47}{66}\right)(16)}{16} = \frac{(.712)(16)}{16} = \frac{11.39}{16}$$

Thus, one sees that the difference in assigning P and D values of 1, versus P and D values of 4, yields a large difference in accumulated values. With P and D scores of "1", the final upper part of the equation is .71. Assigning maximum values of "4" to the P and D analyses results in a final top part of the equation of 11.39 points; a difference of 10.68. Note from the examples above that the value of the lower portion of the equation is also changing. The point to remember here is to take particular care in assigning judgement scores to all components

of the TRAINVICE II model, otherwise an invalid TI may result.

A final word of caution is also offered regarding the clerical task of transposing the values from your master worksheets to computation pages like Tables 8.1 and 8.2. Care must be taken to assure you are recording data accurately and in the correct column. Clerical errors will result in an incorrect TRAINVICE II index.

CONCLUSION AND SUMMARY

TRAINVICE II provides its user with a tool for assessing the transfer-of-training capability of a training device. The areas evaluated regarding the effectiveness of device transfer-of-training include: coverage requirements, actual device coverage of the required skills, training proficiency requirements, learning difficulty and device characteristics (physical and functional). A resulting index is calculated for each device being evaluated. The index (TI) score ranges from "0" to a high of "1" and presents the user with a ranking of the assessed training devices in terms of their transfer-of-training capability.

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APPENDIX A

Behavioral Category Definitions
(Adapted From TRADOC Pam. 350-30)

Behavioral Category Definitions

(Types of Learning)

Behavioral Category #1 -- Rule Learning and Using

- SAMPLE ATTRIBUTES
  1. Choosing a course of action based on applying known rules.
  2. Frequently involves "If--then" situations.
  3. The rules are not questioned, the decision focuses on whether the correct rule is being applied.
- EXAMPLES
  1. Apply the "rules of the road".
  2. Solve mathematical equations (both choosing correct equations and the mechanics of solving the equation).
  3. Carrying out military protocol.
  4. Selection of proper fire extinguisher for different types of fires.
  5. Choosing correct grammar in novel situations covered by rules.

Behavioral Category #2 -- Classifying-Recognizing Patterns

- SAMPLE ATTRIBUTES
  1. Pattern recognition approach to identification -- not problem solving.
  2. Classification by non-verbal characteristics.
  3. Status determination -- ready to start.
  4. Object to be classified can be viewed from many perspectives or in many forms.

- EXAMPLES

  1. Classify a sonar target as "sub" or "non-sub".
  2. Visual classification of flying aircraft as "friend" or "enemy" or as an "F-4".
  3. Determining that an identified noise is a wheel bearing failure not a water pump failure by rating the quality of the noise--not by the problem solving approach.

Behavioral Category #3 -- Identifying Symbols

- SAMPLE ATTRIBUTES

  1. Involves the recognition of symbols such as in codes, diagrams, schematics, etc.
  2. Symbols to be identified typically are of low meaningfulness to untrained persons.
  3. Identification, not interpretation, is emphasized.

- EXAMPLES

  1. Reading electronic symbols on a schematic drawing.
  2. Identifying map symbols.
  3. Reading and transcribing symbols on a tactical status board.
  4. Identifying symbols on a weather map.

Behavioral Category #4 -- Detecting

- SAMPLE ATTRIBUTES

  1. Vigilance--detect a few cues embedded in a large block of time.
  2. Low threshold cues; signal to noise ratio may be very low; early awareness of small cues.
  3. Scan for a wide range of cues for a given "target" and for different types of "targets".

- EXAMPLES

  1. Early sonar detection of a sumbmarine target.
  2. Visually detecting the periscope of a snorkeling submarine during daytime.
  3. Detect, through a slight change in sound, a bearing starting to burn out in a power generator.

Behavioral Category #5 -- Making Decisions

- SAMPLE ATTRIBUTES

  1. Choosing a course of action when alternatives are unspecified or unknown.
  2. A successful course of action is not readily apparent.
  3. The penalties for unsuccessful course of action are not readily apparent.
  4. The relative value of possible decisions must be considered -- including possible trade-offs.

- EXAMPLES

  1. Choosing torpedo settings during a torpedo attack.
  2. Threat evaluation and weapon assignment.
  3. Choice of tactics in combat--wide range of options.
  4. Choosing a diagnostic strategy in dealing with a malfunction in a complex piece of equipment.
  5. Choosing to abort or commit oneself to land upon reaching the critical point in the glidepath.

Behavioral Category #6 -- Recalling Bodies of Knowledge

- SAMPLE ATTRIBUTES

  1. Concerns verbal or symbolic learning.
  2. Concerns acquisition and long-term maintenance of knowledge so that it can be recalled.

- EXAMPLES

  1. Recalling equipment nomenclature or functions.
  2. Recalling system functions, such as the complex relations between system input and output.
  3. Recalling physical laws, such as Ohm's Law.
  4. Recalling specific radio frequencies and other discrete facts.

Behavioral Category #7 -- Performing Gross Motor Skills

- SAMPLE ATTRIBUTES

  1. Perceptual motor behavior; emphasis on motor. Premium on manual dexterity, occasionally strength and endurance.
  2. Repetitive mechanical skills.
  3. Standardized behavior, little room for variation or innovation.
  4. Automatic behavior--low level of attention is required in skilled operator. Kinesthetic cues dominate control of behavior.
  5. Fatigue or boredom may become a factor when skill is performed over an extended period of time or at a rapid rate.
  6. Fine tolerances.
  7. Often a component of a larger task.

- EXAMPLES

  1. Use of hand tools such as hammer, saw, wrench, or power tools such as lathes or grinders.
  2. Running a drill press in an assembly line.
  3. Loading ammunition into artillery pieces of 5" guns.
  4. Drafting--use of drafting instruments.
  5. Painting--house painting or preserving ship hull, etc.
  6. Marching--close order drill.

Behavioral Category #8 -- Steering and Guiding-Continuous Movement

- SAMPLE ATTRIBUTES
  1. Tracking, dynamic control--a perceptual motor skill involving continuous pursuit of a target or keeping dials at a certain reading such as maintaining constant turn rates, etc.
  2. Compensatory movements based on feedback from displays.
  3. Skill in tracking requires smooth muscle coordination patterns--lack of overcontrol.
  4. Involves estimating changes in positions, velocities, accelerations, etc.
  5. Involves knowledge of display-control relationships.
- EXAMPLES
  1. Submarine bow and stern planes operators maintaining a constant course, or making changes in course or depth.
  2. Tank driver following a road.
  3. Sonar operator keeping the cursor on a sonar target.
  4. Air-to-air gunnery--target tracking.
  5. Aircraft piloting such as visually following a ground path.
  6. Helmsman holding a course with gyro or magnetic compass.

Behavioral Category #9 -- Positioning movement and recalling procedures

- SAMPLE ATTRIBUTES
  1. Concerns the chaining or sequencing of events.
  2. Includes both the cognitive and motor aspects of equipment set-up and operating procedures.
  3. Procedural check lists are frequently used as job aids.

- EXAMPLES

  1. Recalling equipment assembly and disassembling procedures.
  2. Recalling the operation and check out procedures for a piece of equipment (cockpit check lists).
  3. Following equipment turn-on procedures--emphasis on motor behavior.

Behavioral Category #10 -- Voice Communicating

- SAMPLE ATTRIBUTES

  1. Speaking and listening in specialized languages.
  2. Often involves the use of a specific message model. Standard vocabulary and format.
  3. Also concerns clarity of voice, enunciation and speed.
  4. Timing of verbalization if usually critical--when to pass information.
  5. Typically characterized by redundancy in terms of information content.
  6. Involves extensive use of previously overlearned verbal skills, or overcoming overlearned interfering patterns.
  7. Tasks may be difficult due to background noises.

- EXAMPLES

  1. Officer giving oral orders and receiving reports.
  2. Sonar operator passing oral information over communications net.
  3. Instructions by ground control operator to pilot in landing aircraft.

- APPENDIX B -

Learning Guidelines

for

Good Instructional Practice

Extracted from TRADOC Pam 350-30,
Interservice Procedures for Instructional
System Development, Phase III

- NOTE -

The letters P and F located in the left-hand margin of this Appendix, refer to the Physical (P) and Functional (F) Characteristics Analysis Components of the TRAINVICE II model. Users are referred to Chapters 6 and 7 of this Guidebook for detailed instructions on how to apply the contents of this Appendix.

LEARNING GUIDELINES

Behavioral Category #1 - Rule Learning and Using

P (1) Pick out the features of the real world job environment which could be used to trigger the trainee's recall of training material which must be used in the rule using part of his job.

P/F (2) Where possible, supply students with diagrams, pictures, charts, graphs, rhymes, key words, and other association devices which the student can use to relate what he already knows to what he is trying to learn.

P/F (3) Encourage students to make up their own association devices if they can and want to do it.

F (4) Where the learner is having a difficult time trying to learn and apply a rule, use specific questions which will help the learner to state the elements and relationships in the rule and thus see how concepts of the rule are related.

F (5) Provide practice until the student learns the rules and learns to apply the rules to the desired level of performance in the operational job setting.

F (6) Positive rewards of the student's correct applications of the rules learned is required in the early stages of training.

F (7) Toward the end of training, the level of positive rewards for correct performance should be reduced to the same level that the student will find on the job.

F (8) Relate the rules to be learned to operational tasks which the trainee must perform in real world assignments.

F (9) Different trainees will have different rates and styles of learning the material. Use techniques which allow students flexibility in learning time.

F (10) Reduce forgetting by providing periodic practice or refresher training for infrequently used material.

F (11) In order for slower learners to reach the same level of proficiency as faster learners, time must be allowed for the slower learner to get as many positive rewards for correct applications of the rules learned as the faster learner.

F (12) At the beginning of the training, the instructor or the material/media should clearly inform the trainee of the learning objectives; that is, what the trainee is expected to be able to do by the completion of training.

F (13) Make sure that the student can recall and demonstrate the concepts which make up the rule; then go on to rule learning.

F (14) Require the learner to state the rule verbally in the learner's own words. This helps the learner recall which concepts make up the rule and how the concepts are arranged.

F (15) Present examples of when the rule applies and when it doesn't.

F (16) Provide opportunities to apply the rule in a variety of new situations in which the learner has not previously been trained to apply the rule.

F (17) During practice, practical applications and practice tests, provide the student with immediate knowledge of results about his correct and incorrect answers.

F (18) Provide rewards for correct application of the rule.

F (19) To test the learner's understanding of the rule, provide an unfamiliar situation in which the rule can be applied, and then require the learner to tell how the concepts of the rule are related to each other and to this situation.

LEARNING GUIDELINES

Behavioral Category #2 - Classifying/Recognizing Patterns

P/F (1) Call student's attention to the important, distinctive features and characteristics of a pattern which distinguish this pattern from other patterns.

P/F (2) Clearly display each of the distinctive features of patterns under study. Show how these cues differ from each other (pre-differentiation of stimuli).

P/F (3) Determine if the trainee can detect distinctive features in patterns that are not to be classified or recognized (ignored) in the training task.

P/F (4) Emphasize distinctive features which can be remembered in the form of mental "pictures" instead of abstract words. When possible, supply students with diagrams, pictures, charts, graphs, rhymes, acronyms, keywords, self instructions, common associations, and other association devices like these to which the student can relate the material he is trying to learn.

P/F (5) Teach students to transform distinctive features of the patterns into items that they can readily recall and make correct actions to.

P/F (6) In instructional presentations and practice, many examples and non-examples of the pattern should be presented.

P/F (7) Toward the end of training, present examples and non-examples of patterns that will be very similar to each other in the job environment.

P/F (8) In early training there should be few irrelevant features, so that identifying the distinctive characteristics of the pattern is fairly easy.

P/F (9) By the end of training, the number of irrelevant cues surrounding distinctive characteristics should be increased to correspond with the real-life situation/job setting.

P/F (10) Provide the student with practice in recognizing examples from the full range of patterns produced by a given object. Make the examples more similar as training progresses. At the end of training, the similarities in the examples should be the similarities that exist in the real world.

P/F (11) Provide a variety of examples of the pattern. Select examples from the full range of variations in the pattern.

P/F (12) To test learning, require the trainee to provide new examples of the pattern, and to teach recognition of the pattern to someone else.

F (13) At the beginning of the training, the instructor or the materials should clearly inform the trainee of the training objectives; that is, what the trainee is expected to be able to do by the completion of training.

F (14) Organize the training material in such a way that the trainee can meet the training objectives at the end of training.

F (15) Relate the objectives and learning activities to operational tasks which the trainee must perform in future real world assignments.

F (16) Positive rewards of the students' correct recognition of patterns is required in the early stages of training.

F (17) Toward the end of training, the level of positive rewards for correct performance should be reduced to the same level that the student will find on the job.

F (18) Provide plenty of opportunities for students to practice making recognitions of each pattern being learned.

F (19) In practice and practice tests, provide for immediate knowledge of results to help the student meet the learning objectives by making each action of the task correct.

F (20) The pause <u>following</u> knowledge of results should be long enough to allow the student time to sort out his errors and pick out distinctive features of the pattern to be classified.

F (21) Different trainees will have different rates and styles of learning the material. Provide flexibility in the time allowed.

F (22) In order for slower learners to reach the same level of proficiency as faster learners, time must be allowed for

the slower learner to get as many or more positive rewards for correct answers as the faster learner.

F (23) Be sure that students develop a strong tendency to look for certain critical and distinctive patterns and develop the same kind of expectations they will need to have while on the job.

F (24) Require the student to overlearn the original material; that is, the student should continue to practice the required tasks after the point that simple mastery of the task has been met.

F (25) Reduce forgetting by providing periodic opportunity to recall and apply infrequently used material.

LEARNING GUIDELINES

Behavioral Category #3 - Identifying Symbols

P (1) Pick out features of the real world job environment which could be used to spark the trainees' recall of associated material which would likely be used in the job or its parts.

P/F (2) If there are very similar symbols (or features of parts of symbols) which have been frequently confused in the past, then be sure that the students can tell the difference between the symbols (or their parts) before they are taught actions to take for each one.

P/F (3) *During instruction, the presentation* of the symbol should be followed immediately by the presentation of its meaning (contiguity principle).

P/F (4) When possible, supply students with diagrams, pictures, charts, graphs, rhymes, acronyms, key words, and other association devices to which the student can relate what he is trying to learn.

F (5) Clearly relate the learning objectives and learning activities to operational tasks, which the trainee must perform in future real world assignments.

F (6) Break the overall learning task down into manageable steps or units when any of the following conditions exist:

a. lower ability students

b. complex material

c. overall task contains many small parts

F (7) Change the order of presenting material during practice so that each training item will be learned equally well.

F (8) Encourage the students to make up their own association devices if they can and want to.

F (9) When possible, provide the students with association devices which will cause an emotional reaction in the student.

F (10) Allow for self-paced practice and provide the student with knowledge of the results of his identifications.

F (11) Reduce forgetting by providing periodic recall and practice for infrequently used material.

F (12) Require the student to overlearn the original material; that is, the student should continue to practice the required tasks after the point that simple mastery of the task has been met.

F (13) Practice and test situations should require the student to make written or verbal answers so that the accuracy of his recall can be checked.

F (14) Different trainees will have different rates and styles of learning the material. Provide flexibility in learning time alotted.

F (15) Positive reward of the student's correct identification of symbols and provision of immediate knowledge of result is

required in the early stages of training.

F (16) Toward the end of training, the level of positive rewards and knowledge of results should be reduced to the same level that the student will find on the job.

LEARNING GUIDELINES

Behavioral Category #4 - Detecting

P/F (1) Train student to use systematic search procedures utilizing whatever senses (sight, hearing, etc.) are appropriate for the task.

P/F (2) Provide examples of correct performance of the task where appropriate.

P/F (3) In presenting signals, sample from the full range of types of signals. Include the different signal sources to be encountered on the job and the different patterns of each signal source.

P/F (4) Train the student to use the detected signal as a cue to search for and verify the existence of the signal in a second sense modality, where it is possible for the signal to be detected by more than one sense, and when a student thinks he has detected the signal through one sense.

P/F (5) Where appropriate, train the student to use peripheral vision when scanning with the eyes.

- The following (6 - 11) are guidelines for managing <u>earlier stages</u> of training.

P/F (6) Provide a high signal density more frequent than in the operational task.

P/F (7) Signals should have high signal-to-noise ratio

P/F (8) Use different amounts of time between signal presentation.

P/F (9) Insure a high frequency of student identifications of the signal.

P/F (10) Provide student with immediate and continuous knowledge of results

P/F (11) Do not teach any vigilance techniques

- The following (12 - 16) are guidelines for managing <u>intermediate stages</u> of training.

P/F (12) Use a lower signal density

P/F (13) Use lower signal-to-noise ratios

P/F (14) Use different amounts of time between signal presentations.

P/F (15) Provide student with intermittent knowledge of results.

P/F (16) Introduce vigilance techniques

- The following (17 - 21) are guidelines for managing <u>advanced stages</u> of training.

P/F (17) Low signal density; i.e., operational density or minimum number suited to training.

P/F (18) Decrease signal-to-noise ratio to operational level

P/F (19) Use different amounts of time between signal presentations.

P/F (20) Provide the student with knowledge of results equivalent.

P/F (21) Require vigilance techniques appropriate to the job setting.

P/F (22) Train the student to monitor his own vigilance level by conditioning him to respond to biological conditions (internal cues) which appear when vigilance begins to fade.

F (23) At the beginning of the training, the instructor or the material/media should clearly inform the trainee of the learning objectives; that is, what the trainee is expected to be able to do by the completion of training.

F (24) Relate the learning objectives and learning activities to operational tasks which the trainee must perform in future real world assignments.

F (25) Train the student in techniques of vigilance; train him to establish a mental "set" to search. Use instructions to establish this "set" and provide a positive reward when the student achieves a proper "set."

F (26) Provide knowledge of results on correct detections. This can serve as positive reward to encourage vigilance behaviors that will lead to continued correct detections.

F (27) Ensure that detections <u>are correct</u> before providing positive reward.

F (28) Do not allow a student to leave one phase or level of the learning task until he has achieved the required level of mastery.

LEARNING GUIDELINES

Behavioral Category #5 - Making Decisions

P/F (1) Provide the student with a wide variety of decision making experiences. Provide basic problems where there are only a few factors to consider. Also provide complex problems which require the student to consider many factors. The solutions should range from easy to hard.

P/F (2) If the trainee will be required to make the decision under stress in the real world, then he must overlearn the decision making skill during training. That is, he must be able to make the correct decision, and he must be able to make the decision efficiently, accurately, and repeatedly in distracting surroundings.

P/F (3) During the final stages of training, it is important to provide situations which closely duplicate the real world with respect to amount of data, type of data, amount of time to complete the decision making problems, and the amount of distraction and "noise" in the working environment.

F (4) At the beginning of the training, the instructor or the materials should clearly inform the trainee of the learning objectives; that is, what the trainee is expected to be able to do by the completion of training.

F (5) At the beginning of training, relate the learning objectives and learning activities to operational tasks which the trainee must perform in future real world assignments.

F (6) For the most efficient learning of decision making the student must already have learned the technical knowledge which will allow him to identify what the problem really is, make a list of the most reasonable solutions, and determine which of the solutions would be best.

F (7) The student will learn best if he is not afraid of making incorrect decisions in the training situations; this is particularly true in the early stages of training and in very complex decision making processes. Materials and instructors should, therefore, attempt to decrease student fears to a low level.

F (8) Give the students examples of these two types of actions which are to be avoided when making decisions:

a. response biases; that is, the tendency to make a "favorite" decision or use a "favorite" solution regardless of the real nature of the problem.

b. perceptual sets; that is, the tendency to generalize problems or view several types of problems as if they were all the same when, in fact, they are quite different.

F (9) Teach the students a set of steps to follow in making decisions such as the following 5-step model:

a. Discover the existence of a problem and define it

b. Identify and collect relevant information

c. Develop reasonable solutions to the problem

1) compare alternative solutions

2) combine alternate solutions where desirable

d. Evaluate each of the proposed solutions.

1) how will each solution solve the problem?

2) will each solution bring about any additional benefits or problems?

3) rank each solution according to the results it would bring.

e. Decide on the best solution and put it into effect.

F (10) Provide the student with enough realistic information and data on which to formulate possible solutions and make final decisions. Be sure that the student makes decisions in the same variety of settings as he will face in carrying out his job.

F (11) Provide the learner with knowledge of results for each decision he makes. A recommended list of questions to ask about the learner's problem solutions follows:

a. Predictable? (Were evidences of perceptual sets shown in his solution?)

b. Perseverated? (Were evidences of response biases shown in solution?)

c. Timely? (Is this the appropriate time to execute this particular decision?)

d. Complete? (Did he consider all of the data and information?)

e. Consistent? (Is his solution compatible and relevant to the data and the available information?)

F (12) Give knowledge of results with respect to the student's decisions each time. Where possible, provide the actual consequences of the learner's decision.

LEARNING GUIDELINES

Behavioral Category #6 - Recalling Bodies of Knowledge

P (1) Arrange for features of the real world job setting to be used to trigger the trainee's recall of training material--the knowledge he needs to do the job.

P (2) Use high interest, attention-getting features of the learning materials throughout the training. Keep student attention by using learning activities which require active student participation.

P/F (3) Make the learning activities relevant by making them similar to real-life tasks that the student will be performing on the job.

P/F (4) If the real world job will present the trainee with very <u>similar features of the job situation</u> which will require the trainee to remember <u>different knowledge</u> for each feature, make sure that the trainee learns the difference between these features before he is taught which body of knowledge to associate with each feature.

P/F (5) When possible, supply students with diagrams, pictures, charts, graphs, rhymes, acronyms, key words, and other association devices to which the student can relate the facts and principles he is trying to learn and recall them more easily.

P/F (6) In early phases of training, provide the student with guides, prompts, cues, and coaching which will help him

remember the material correctly.

P/F (7) As training progresses, prompts should be reduced until it matches the level of help that will be available in the real world job setting.

P/F (8) Provide students with opportunities to practice their training tasks by setting up a wide variety of testing and practice situations which are very similar to situations the learner will encounter on the job.

P/F (9) Practice and test situations should require the student to make written or verbal answers so that the accuracy of his recall of the facts and principles he learned can be checked.

F (10) At the beginning of the training, the instructor or the material/media should clearly inform the trainee of the learning objectives; that is, what the trainee is expected to be able to do by the completion of training to meet the learning objectives.

F (11) Analyze the subject body of knowledge to detect key words, formulas or phrases. Organize the learning activities around these key items.

F (12) Before testing for recall, provide some warm-up exercises (or) an introduction to remind the student of the type of task and the type of information needed.

F (13) If it is necessary for the student to learn similar bodies of subject matter, then directly compare the

bodies when they are first presented so that the student can tell them apart (or) separate their presentation by as much time as possible to avoid confusion between them.

F (14) Encourage and give students directions to make up their own association devices if they can and want to.

F (15) When possible, provide students with association devices which will cause an emotional reaction in the student.

F (16) During the training sessions, provide the student with immediate knowledge of results about his correct and incorrect answers.

F (17) Provide positive rewards during the instruction, even during non-testing situations. Reward a student's progress, attitude, attention, mastery of an objective, etc.

F (18) In practice and practice tests, provide for immediate knowledge of results to help the student retain correct answers and eliminate incorrect answers.

F (19) Change the order of presenting the material during practice so that each item in the list will be learned equally well.

F (20) Rest periods should be provided during practice sessions according to need for rest as judged by the student and requirements of the specific learning material as judged by the instructor.

F (21) Different trainees will have different rates and styles of learning the material. Try to provide flexibility in time to learn.

F (22) In order for slower learners to reach the same level of proficiency as faster learners, time must be allowed for the slower learner to get as many or more positive rewards for correct answers as the faster learner.

F (23) As training continues, give the learner chances to compare his progress and achievement with the stated learning objectives.

F (24) Test to see that the student is able to correctly recall key features that will help him recall the knowledge he needs in performing his job.

F (25) Provide the student with practice in associating the knowledge to be learned with key features of the job setting.

F (26) Prevent forgetting by showing the meaningfulness of the material to the learner's job environment and duties. Emphasize the organization and structure of the material.

F (27) Require the student to overlearn the original material; that is, the student should continue to practice the required tasks after the point that simple mastery of the training task has been met.

LEARNING GUIDELINES

Behavioral Category #7 - Performing Gross Motor Skills

P (1) Teach the learner to tell the difference between similar external cues (conditions, features, characteristics, etc. or objects in the job environment to which the learner must respond with an appropriate action) like knowing when too much pressure is put on a power saw the wood begins to smoke.

P (2) Teach the learner to tell the difference between similar internal cues (muscular feelings inside one's body which guide the execution of a physical skill and allow automatic responses) like knowing by the "feel" of the power saw how much pressure to use without burning the wood.

P/F (3) Early in training, present immediate and specific knowledge of results to the student.

P/F (4) Early in training, present external cues that will bring out the desired responses in the student's actions.

P/F (5) Later in training, training should reduce the knowledge of performance results to on-the-job levels.

P/F (6) Later in training, training should train the student to respond to internal cues in his muscles to guide his actions in correctly performing the task.

P/F (7) If students make incorrect actions or begin to develop bad habits, a penalty is presented following these improper responses until they disappear.

P/F (8) To insure that the learner understands the required task, the training media should independently demonstrate/correct performance of the task.

P/F (9) To insure that the learner understands required subtasks, the training media should independently demonstrate component parts of the task.

P/F (10) To insure that the learner understands required task and subtasks, training media permits the instructor/student to describe and/or demonstrate the desired task and its component parts.

P/F (11) Provide for learner practice on parts (specific components) of the task for:

1) simple task-practice in entirety
2) complex task practice in parts and then in entirety

P/F (12) Provide for learner practice under varied conditions so as to:

1) facilitate the performance of the motor task
2) help adapt the performance of this task to potential environmental changes

P/F (13) Ensure that during practice the learners:

1) understand the objectives of the skill while learning
2) can observe a skilled performance of the desired task as often as necessary
3) can obtain knowledge of results concerning his performance of the task

P/F (14) Ensure that during practice the learners have short rest periods mixed in with the practice methods

P/F (15) Provide real life distractions, interruptions, and "noise" to the level that the person will encounter on-the-job, when and where appropriate.

F (16) At the beginning of training, the learning objective is made clear and apparent to the trainee.

F (17) At the beginning of training, the trainer clearly relates the learning objectives and learning activities to operational tasks which the trainee must perform in future real world assignments.

F (18) Feed back to student knowledge of results; student learns:

1) what he is doing right
2) what he is doing wrong

F (19) Feed back to student comparisons; student learns how what he did compares to the:

1) learning objectives of the program
2) correct demonstration of task
3) standards that are required in operational setting

F (20) The pause following knowledge of results should be long enough to allow the student time to sort out his errors and to rest his muscles.

F (21) Reward performances which are closer to the goal than the preceeding performances. In this manner, the student's performance will become successively closer to the desired performance (shaping).

F (22) After the student successfully reaches the desired performance, reduce the frequency of reward to the level found on the job.

F (23) Require the student to overlearn the original material; that is, the student should continue to perform the required tasks after the point that simple mastery of the task has been met.

F (24) Allow for individual variation in physical coordination and provide extra time and practice for those who learn the skills less readily.

F (25) Reduce forgetting by providing periodic practice for infrequently used skills.

LEARNING GUIDELINES

Behavioral Category #8 - Steering and Guiding/Continuous Movement

P (1) Critical cues, from which the trainee gets feedback on how well the task was performed, must be realistic and continually available during the performance of the task.

P (2) In continuous control task training, maintain a high level of real world conditions in the presentation of cues to which the trainee must react, the actions and reactions which the trainee makes, and the way that the displays and controls of the system continuously respond to the trainee's control.

P/F (3) Demonstrate correct task performance with a model.

P/F (4) Provide practice under a variety of conditions.

P/F (5) Provide practice on specific component skills when learning complex tasks.

P/F (6) Give the student knowledge of results on small, distinct segments of his performance, especially during early stages of learning.

P/F (7) Teach the student to scan continuously by specific training of eye movement and where to focus for scanning.

F (8) At the beginning of the training, the instructor or the materials should clearly inform the trainee of the learning objectives.

F (9) Relate the learning objectives and activities to operational tasks which the trainee must perform in future real world assignments.

F (10) Provide a preview of important, selected motions and movements that the student will learn to make.

F (11) Break the overall learning task down into manageable steps or unit when any of the following conditions exist:

a. lower ability students

b. complex material

c. the overall task contains many small parts and is so long that the student or instructor thinks that only a part of it at a time should be learned.

F (12) Highly skilled performance requires extensive practice; This practice should provide:

a. an understanding of skill objectives

b. the student can observe skill performances

c. the student is given adequate opportunity to practice on the task

d. student receives knowledge of results

e. rest periods to be mixed in with the practice periods when the trainee feels that he needs them.

F (13) Positive reward should be provided for performances which are closer to goal than preceeding performances. In this manner, the student's performance will become successively closer to the desired performance (shaping).

F (14) Positive reward should follow as soon as possible after each correct student performance; initially after each distinct segment of performance and toward the end of training after each maneuver or complete evolution.

LEARNING GUIDELINES

Behavioral Category #9 - Positioning Movement and Recalling Procedures

P (1) Provide a visual demonstration of the physical skill that the trainee is expected to perform at each step in the checklist of procedures.

P (2) Pick out features of the real world job environment which could be used to spark the trainees' recall of training material which must be used in that part of his job.

P (3) Provide realism for procedural and physical skills practice:

a. equipment realism can be at a minimum level; for example, a photo of the job setting or a paper and plywood model

b. checklist items and their corresponding procedural responses need to be as realistic as possible

P/F (4) Break the physical skills (positioning movement) into logical sub-units or part skills. Then make sure that the procedural steps for each of these sub-units are well organized.

P/F (5) Break the overall learning task down into manageable steps or units when any of the following conditions exist:

a. lower ability students

b. complex material

c. overall task contains many small parts

P/F (6) If the checklist presents the trainee with <u>similar checklist</u> items which in the past have been frequently confused, then

be sure that the trainee can explain the differences between these similar checklist items before he is taught which action to take for each one.

P/F (7) When possible, supply students with diagrams, pictures, charts, graphs, rhymes, acronyms, key words, and other association devices like these to which the student can relate the material he is trying to learn.

- The following (8-13) are guidelines for providing the trainee with practice:

P/F (8) Ensure that the trainee has a lot of opportunity to practice physical skills early in the training.

P/F (9) Be sure the trainee understands the learning objectives.

P/F (10) Provide a visual demonstration of the correct performance

P/F (11) Allow the trainee to practice part-skills and provide feedback to train him to perfect the movement.

P/F (12) Integrate the part-skills into a smooth sequence.

P/F (13) Provide feedback so the trainee can improve his performance.

- The following (14-19) are guidelines for managing earlier stages of training.

P/F (14) Provide immediate and frequent knowledge of results.

P/F (15) Provide immediate and frequent positive reward.

P/F (16) Provide few or no distractions

P/F (17) Learning material should be broken down into small, easily learned parts.

P/F (18) Items should be relatively easy to learn

P/F (19) Provide guides, prompts, cues, and coaching to aid learning.

- The following (20-25) are guidelines for managing <u>later</u> stages of learning.

P/F (20) Provide occasional, delayed feedback.

P/F (21) Provide occasional, delayed reward of students' correct movements.

P/F (22) Distractions and interferance should be similar to what will be found on the job.

P/F (23) Learning material to be recalled and used should be as it would be found on the job.

P/F (24) Learning material should be as complex as that to be used on the job.

P/F (25) Use no guides or prompts that would not be found on the job.

F (26) At the beginning of the training, the instructor or materials/ media should clearly inform the trainee of the learning objectives.

F (27) Organize the training material in such a way that the trainee can easily identify and achieve the learning objectives throughout the training.

F (28) Relate the objectives and learning activities to operational tasks which the trainee must perform in future real world assignments.

F (29) Encourage the students to make up their own association devices if they can.

F (30) When possible, provide students with association devices which will cause an emotional reaction in the student.

F (31) To help students remember a chain of procedures, it is useful to practice identifying checklist items. Some examples are:

a. identifying each checklist item and explaining or performing its corresponding procedure

b. identifying a group of checklist items (as many as the student can handle at once) and explaining or performing their corresponding procedural steps; the first items of each group should overlap with the last items of the previously studied group

c. identifying all of the checklist items and explaining or performing their corresponding procedural steps

d. encourage students to mentally practice running through the steps in the checklist

F (32) Help students to use association devices that are easy to remember, to aid in the recall of procedures.

F (33) Positive reward should follow as soon as possible after a correct answer.

F (34) The pause <u>following</u> knowledge of results should be long enough to allow the student time to sort out his errors or mentally confirm his correct answer (post-feedback delay).

F (35) Rest periods should be provided during practice sessions according to need for rest as judged by the student (or) requirements of the specific learning material as judged by the instructor.

F (36) Overlearn the task through extensive practice.

F (37) In order for slower learners to reach the same level of proficiency as faster learners, time must be allowed for the slower learner to get as many (or more) positive rewards for correct answers as the faster learner.

F (38) As training continues, occasionally give the learner chances to compare his progress and achievement with the stated course objectives.

F (39) Train the student to the level of proficiency required on the job. Facilitate acquisition of the material by relating it to on-the-job duties, responsibilities, advancement, or survival.

F (40) Reduce forgetting by providing periodic practice for infrequently used procedures.

LEARNING GUIDELINES

Behavioral Category #10 - Voice Communicating

P (1) Break up the presentation material into separate, distinctive types of voice communication that are used on the job.

P (2) Point out critical cues and performances that are different from habitual (everyday type) voice communication.

P/F (3) Identify similar cues (sounds, words, groups of words, vocal patterns, etc.) that are often confused in job communications and test the student to be sure that he can tell the difference between them.

P/F (4) Teach the student to be mentally alert (perceptual set) for the specific voice communications being taught; that is, teach the student to listen for certain words and phrases.

P/F (5) Demonstrate a voice procedure by giving examples of correct performance. Be sure the learner observes critical cues and the appropriate responses that he should make to them.

P/F (6) Toward the end of training, increase stress and miscellaneous interruptions, distractions, and "noise" to the level that will appear on the job.

P/F (7) Toward the end of training, practice voice communication procedures to the level that they will have to be performed in the job setting.

P/F (8) At the beginning of the training, the instructor or the materials should clearly inform the trainee of the learning objectives.

F (9) Organize the training material in such a way that the trainee can easily identify and meet the learning objectives.

F (10) Relate the learning objectives and activities to operational tasks which the trainee must perform in future real world assignments.

F (11) Present a brief overview of the activities in which the students will participate during training.

F (12) Before demonstrating specific procedures and techniques, teach general voice communication terminology and procedure.

F (13) Require enough practice trials of the learner to produce the correct performance; he should especially practice parts he is having difficulty with until he can demonstrate the correct procedure.

F (14) During practice, practical applications, and practice tests, provide the student with immediate knowledge of results about his correct and incorrect answers.

F (15) Positive reward should follow as soon as possible after a correct answer.

F (16) Rest periods should be provided during practice sessions according to need for rest as judged by the student and requirements of the specific learning material as judged by the instructor.

F (17) Cross-train the learner so that he may perform other voice communication tasks and be able to act as a replacement for other members of his team.

F (18) Require the student to overlearn the original material; that is, the student should continue to practice the required tasks after the point that simple mastery of the task has been met.

F (19) Reduce forgetting by providing periodic practice for infrequently used material.

F (20) Provide a large reward when trainee meets overall training objectives and required overlearning.

APPENDIX C

Prescriptive Application of TRAINVICE II

PRESCRIPTIVE APPLICATION OF TRAINVICE II

TRAINVICE II, as presented in this Guidebook, is explained for its "predictive" application. The predictive application of the model serves those situations where, in most cases, the analyst must evaluate real, existing training devices against trainee performance requirements in the operational setting. The predictive application may also be used with preliminary concepts or designs if enough information or detail is available. A second type of application, however, is both practical and possible with TRAINVICE II. This is termed the "prescriptive" application and is the subject of discussion in this Appendix.

The prescriptive application of TRAINVICE II is used by the analyst to test a concept for a training device which is not yet developed (or) a device developed but in need of further refinement. As such, the prescriptive mode of TRAINVICE II is most helpful in the training device "design" stage. In effect, it serves as a paper-and-pencil test of design alternatives against operational setting requirements. In essence, the prescription application can provide input to the design process in order to develop the concept or design.

In this TRAINVICE II Guidebook, two ficticious training devices called SHERMAN and PATTON were compared. While the user was asked

to assume these devices to be real and thus to apply TRAINVICE II predictively (i.e., predict their transfer-of-training capabilities), SHERMAN and PATTON could just have easily been two design proposals for a new type of simulator.

In the prescriptive application of TRAINVICE II, the analyst will likely not be concerned solely with the terminal TRAINVICE II score. Instead, the user will also study task requirements and actual training coverage of those requirements by a device's design. The prescriptive application of TRAINVICE II involves in-depth study of the overall data generated; the purpose being to prescribe design improvement. The predictive application, on the other hand, is mainly concerned with the final device score and the superiority of one device over another.

APPENDIX D

TRAINVICE II Procedures Checklist

APPENDIX D

TRAINVICE II PROCEDURES CHECKLIST

This Appendix is intended to serve as a job performance aid for users of TRAINVICE II. The procedures checklist provided herein presumes that the user has read, studied, and is thoroughly familiar with the TRAINVICE II Guidebook. Do not attempt to implement TRAINVICE II procedures through use of this checklist unless you have studied the manual and are competent in its procedures.

The appendix provides a step-by-step checklist for completing each component of the TRAINVICE II model. In doing so, the following task prompts are provided to the user for each model component:

(A) Procedures Checklist - Briefly describes in sequence each step of the particular analysis being conducted. It is the actual checklist of the procedure necessary to complete the component.

(B) Completed Examples - Provides the user with actual examples of completed data worksheets for the particular analysis being conducted. In all examples, the fictitious SHERMAN and PATTON training simulators (described in Chapter 3 of the TRAINVICE II manual) are used for illustration.

(C) Procedures Flowchart - Graphically depicts the flow of steps described in the Procedures Checklist (A). The flowchart allows the user to track procedures visually and see the interrelationships among the various steps involved.

The preliminary steps for preparing the basic TRAINVICE II inputs are also included. These are mainly concerned with Task Analysis and developing the Consolidated List of skills and knowledges. Final computation of the TRAINVICE II INDEX (TI) is detailed as the last part of the checklist. Flowcharts are not included for these two operations. Instead, examples alone serve to illustrate the checklist procedures.

All examples provided throughout the checklist are those used in the TRAINVICE II Guidebook. This is intended to facilitate user reference to and recall of TRAINVICE II procedures and corresponding instructions for their use.

TRAINVICE II PROCEDURES CHECKLIST

PRELIMINARY INPUT REQUIREMENTS

- PURPOSE: TO OBTAIN AND ESTABLISH THE BASIC INPUT INFORMATION UPON WHICH ALL SUBSEQUENT TRAINVICE II ANALYSES WILL BE BASED.

Procedures Checklist		Guidebook Reference
No. 1.0	Obtain complete Task Analysis of the operational setting performance for which the student is to be trained. Task Analysis procedures are described in TRADOC Pamphlet 350-30. For the performance area, the Task Analysis must report all required: • Tasks • Subtasks • Skills • Knowledges	1-8;1-9;2-1; 2-5;2-7
No. 2.0	List each task, its corresponding sub-tasks, and its required skills and knowledges in a master task list. Do not omit any task or its corresponding components. An example of such a master task list is shown as Figure D-1.	2-1;2-2;2-6

TASK

1. Load the Launch Tube

SUBTASK

1.1 Lock traversing unit in azimuth and elevation

SKILL

1.1.1 Operate traversing unit

KNOWLEDGES

1.1.2 Azimuth and elevation movement
1.1.3 Locking mechanism

SUBTASK

1.2 Remove encased missile from stowed position

SKILL

1.2.1 Remove casing materials from missile

KNOWLEDGES

1.2.2 Missile configuration
1.2.3 Casing materials

SUBTASK

1.3 Load encased missile

SKILLS

1.3.1 Loading procedure
1.3.2 Locking procedure

KNOWLEDGES

1.3.3 Safety aspects of launch tube preparation
1.3.4 Loading and locking mechanisms

TASK

2. Select a Target

SUBTASK

2.1 Visually select target

SKILL

2.1.1 Descrimination of enemy targets from other targets

KNOWLEDGES

2.1.2 Silhouettes of threat vehicles
2.1.3 Scanning techniques

SUBTASK

2.2 Swing traversing unit to align optical sight

SKILL

2.2.1 Operate traversing unit

KNOWLEDGES

2.2.2 Azimuth and elevation movement
2.2.3 Locking mechanism
2.2.4 Unlocking procedures

TASK

3. Connect Encased Missile

SUBTASK

3.1 Insure personnel are clear of firing danger zone

SKILL

3.1.1 Monitoring danger area

KNOWLEDGE

3.1.2 Danger zone areas

SUBTASK

3.2 Raise aiming lever

SKILL

3.2.1 Operating aiming lever

KNOWLEDGES

3.2.2 Position and function of aiming lever

TASK

4. Acquire and Track Target

SUBTASK

4.1 Turn on and adjust vehicle light if needed

SKILL

4.1.1 Operation of light switch

KNOWLEDGE

4.1.2 Light switch operating procedures

SUBTASK

4.2 Operate focus control

SKILL

4.2.1 Perform focusing procedures

KNOWLEDGES

4.2.2 Locate focus control
4.2.3 Focusing control operation

SUBTASK

4.3 Operate traversing sight

SKILL

4.3.1 Perform traversing movement

KNOWLEDGES

4.3.2 Traversing sight location
4.3.3 Traversing sight procedures

SUBTASK

4.4 Operate optical sight

SKILL

4.4.1 Perform SOP for optical sighting

KNOWLEDGES

4.4.2 Optical sighting location
4.4.3 Optical sighting procedures

TASK

5. Launch Missile

SUBTASK

5.1 Lift trigger protective cover

SKILL

5.1.1 Unlock trigger protective cover

KNOWLEDGES

5.1.2 Trigger protective cover location
5.1.3 Unlocking procedures

SUBTASK

5.2 Press firing trigger

SKILL

5.2.1 Perform firing procedures

KNOWLEDGES

5.2.2 Firing trigger location
5.2.3 Missile firing procedures

TASK

6. Track Target Until Missile Impact

SUBTASK

6.1 Make continuous adjustments to keep crosshairs centered on target

SKILLS

6.1.1 Perform focusing procedures
6.1.2 Perform traversing procedures
6.1.3 Perform optical sighting procedures

KNOWLEDGES

6.1.4 Azimuth and elevation movement
6.1.5 Focus control location
6.1.6 Focusing control operation
6.1.7 Traversing sight location
6.1.8 Traversing sight procedures
6.1.9 Optical sight location
6.1.10 Optical sight procedures

Figure D-1

Operating TASKS, SUBTASKS, SKILLS and KNOWLEDGES for Anti-Armor M

Procedures Checklist		Guidebook Reference
No.-3.0	Obtain the instructor's manual and the design manual for each device to be assessed with TRAINVICE II. Retain these for reference throughout the analysis.	NONE
No.-4.0	Proceed with the first TRAINVICE II component: Coverage Requirements (CR) Analysis.	2-1 to 2-12

TRAINVICE II PROCEDURES CHECKLIST

"CR"

COVERAGE REQUIREMENTS ANALYSIS

- **Purpose:** To determine what skills and knowledges must be covered by the training device in order to assure that trainee performance will adequately transfer to the operational setting.

Procedures Checklist		Guidebook Reference
CR-1.0	Review the master task list (established in NO-2.0) and identify any repetitive subtasks, skills, or knowledges.	
CR-1.1	If any repetitions are found, retain the original and strike the redundancies from the list. Call this new list the Consolidated List. A "before and after" example is provided in Table D1.	2-1;2-2;2-3; 2-4;2-7
CR-1.2	If no repetitions are found in the master task list, retain it in its entirety and thereafter regard it as the Consolidated List.	2-1;2-2;2-12

Table D1-A
Original List of Operating Tasks, Subtasks, Skills and Knowledges for Anti-Missile System

1. Load the launch Tube
   - 1.1 Lock traversing unit in azimuth and elevation
     - 1.1.1 Operate traversing unit
     - 1.1.2 Azimuth and elevation movement
     - 1.1.3 Locking mechanism
   - 1.2 Remove encased missile from stowed position
     - 1.2.1 Remove casing materials from missile
     - 1.2.2 Missile configuration
     - 1.2.3 Casing materials
   - 1.3 Load encased missile
     - 1.3.1 Loading procedure
     - 1.3.2 Locking procedure
     - 1.3.3 Safety aspects of launch tube preparation
     - 1.3.4 Loading and locking mechanisms
2. Select a Target
   - 2.1 Visually select target
     - 2.1.1 Descrimination of enemy targets from other targets
     - 2.1.2 Silhouettes of threat vehicles
     - 2.1.3 Scanning techniques
   - 2.2 Swing traversing unit to align optical sight
     - 2.2.1 Operate traversing unit
     - 2.2.2 Azimuth and elevation movement
     - 2.2.3 Locking mechanism
     - 2.2.4 Unlocking procedures
3. Connect Encased Missile
   - 3.1 Insure personnel are clear of firing danger zone
     - 3.1.1 Monitoring danger area
     - 3.1.2 Danger zone areas
   - 3.2 Raise aiming lever
     - 3.2.1 Operating aiming lever
     - 3.2.2 Position and function of aiming lever
4. Acquire and Track Target
   - 4.1 Turn on and adjust vehicle light if needed
     - 4.1.1 Operation of light switch
     - 4.1.2 Light switch operating procedures
   - 4.2 Operate focus control
     - 4.2.1 Perform focusing procedures
     - 4.2.2 Locate focus control
     - 4.2.3 Focusing control operation
   - 4.3 Operate traversing sight
     - 4.3.1 Perform traversing movement
     - 4.3.2 Traversing sight location
     - 4.3.3 Traversign sight procedures
   - 4.4 Operate optical sight
     - 4.4.1 Perfrom SOP for optical sighting
     - 4.4.2 Optical sighting location
     - 4.4.3 Optical sighting procedures
5. Launch Missile
   - 5.1 Lift trigger protective cover
     - 5.1.1 Unlock trigger protective cover
     - 5.1.2 Trigger protective cover location
     - 5.1.3 Unlocking procedures
   - 5.2 Press firing trigger
     - 5.2.1 Perform firing procedures
     - 5.2.2 Firing trigger location
     - 5.2.3 Missile firing procedures
6. Track Target Until Missile Impact
   - 6.1 Make continuous adjustments to keep crosshairs centered on target
     - 6.1.1 Perform focusing procedures
     - 6.1.2 Perform traversing procedures
     - 6.1.3 Perform optical sighting procedures
     - 6.1.4 Azimuth and elevation movement
     - 6.1.5 Focus control location
     - 6.1.6 Focusing control operation
     - 6.1.7 Traversing sight location
     - 6.1.8 Traversing sight procedures
     - 6.1.9 Optical sight location
     - 6.1.10 Optical sight procedures

Table D1-B
Consolidated List of Skills and Knowledges for each Task and Subtask

1. Load the Launch Tube
   - 1.1 Lock traversing unit in azimuth and elevation
     - 1.1.1 Operate traversing unit
     - 1.1.2 Azimuth and elevation movement
     - 1.1.3 Locking mechanism
   - 1.2 Remove encased missile from stowed position
     - 1.2.1 Remove casing materials from missile
     - 1.2.2 Missile configuration
     - 1.2.3 Casing materials
   - 1.3 Load encased missile
     - 1.3.1 Loading procedure
     - 1.3.2 Locking procedure
     - 1.3.3 Safety aspects of launch tube preparation
     - 1.3.4 Loading and locking mechanisms
2. Select a Target
   - 2.1 Visually select target
     - 2.1.1 Descrimination of enemy targets from other targets
     - 2.1.2 Silhouettes of threat vehicles
     - 2.1.3 Scanning techniques
   - 2.2 Swing traversing unit to align optical sight
     - 2.2.1 Unlocking procedures
3. Connect Encased Missile
   - 3.1 Insure personnel are clear of firing danger zone
     - 3.1.1 Monitoring danger area
     - 3.1.2 Danger zone areas
   - 3.2 Raise aiming lever
     - 3.2.1 Operating aiming lever
     - 3.2.2 Position and function of aiming lever
4. Acquire and Track Target
   - 4.1 Turn on and adjust vehicle light if needed
     - 4.1.1 Operation of light switch
     - 4.1.2 Light switch operating procedures
   - 4.2 Operate focus control
     - 4.2.1 Perform focusing procedures
     - 4.2.2 Locate focus control
     - 4.2.3 Focusing control operation
   - 4.3 Operate traversing sight
     - 4.3.1 Perform traversing movement
     - 4.3.2 Traversing sight location
     - 4.3.3 Traversing sight procedures
   - 4.4 Operate optical sight
     - 4.4.1 Perform SOP for optical sighting
     - 4.4.2 Optical sighting location
     - 4.4.3 Optical sighting procedures
5. Launch Missile
   - 5.1 Lift trigger protective cover
     - 5.1.1 Unlock trigger protective cover
     - 5.1.2 Trigger protective cover location
     - 5.1.3 Unlocking procedures
   - 5.2 Press firing trigger
     - 5.2.1 Perform firing procedures
     - 5.2.2 Firing trigger location
     - 5.2.3 Missile firing procedures
6. Track Target Until Missile Impact
   - 6.1 Make continuous adjustments to keep crosshairs centered on target

Table D1

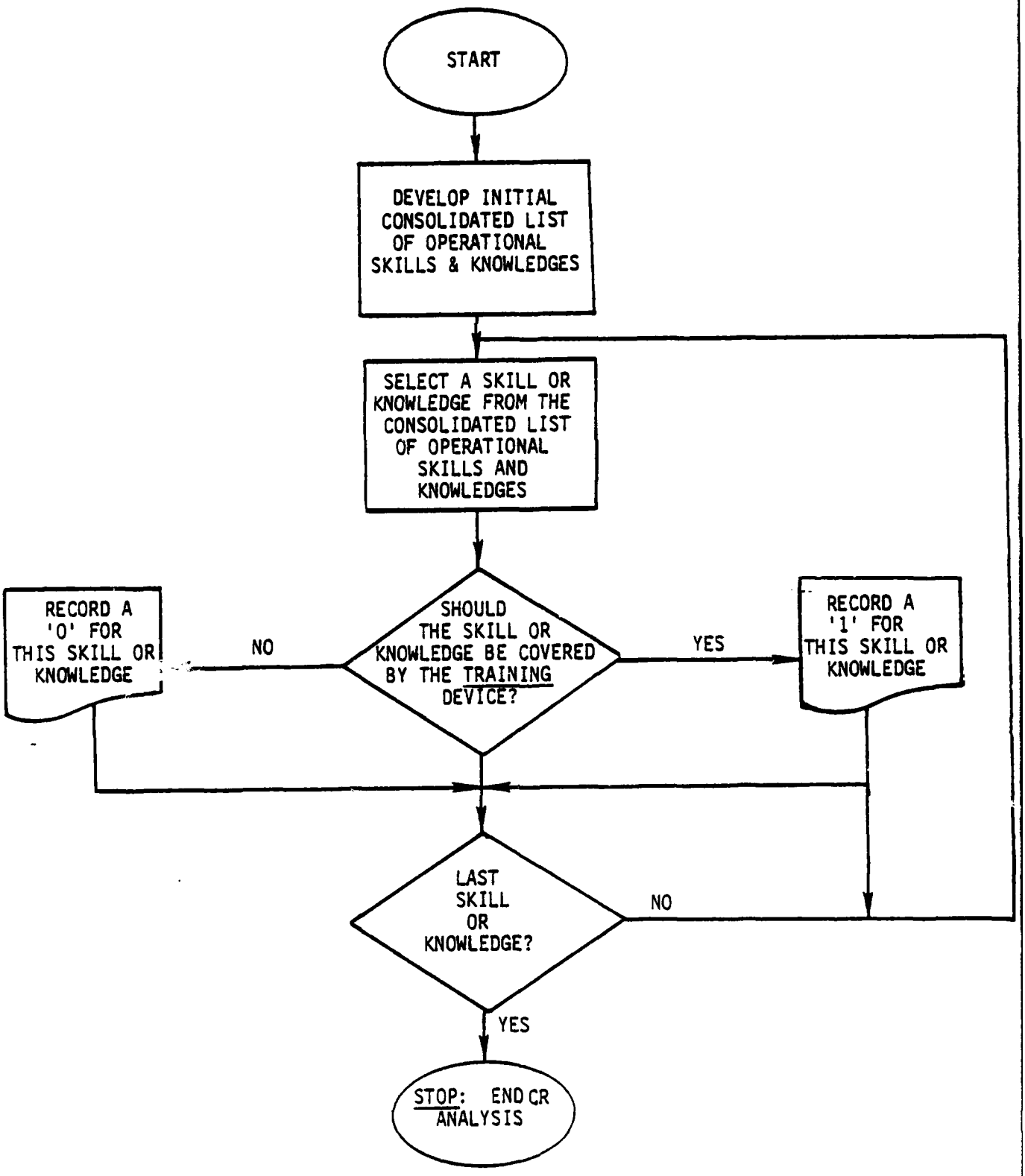
Procedures Checklist		Guidebook Reference
CR-2.0	Record the Consolidated List in the first column of the TRAINVICE II MASTER WORK-SHEET (a blank copy of which is provided in APPENDIX E) as shown in the lefthand column of Figure CR-2.	2-9;2-10
CR-3.0	Review the Consolidated List to identify all tasks and/or corresponding subtasks, skills and knowledges which need to be covered in training by the training device. This is the Coverage Requirements (CR) Analysis. Those NOT necessary to training will be: • Skills/knowledges which trainees already can accomplish. • Skills/knowledges to be taught in another training program.	2-2;2-4;2-9
CR-4.0	Rate each skill/knowledge on the Consolidated List using the following scale: 1 = REQUIRED IN TRAINING 0 = NOT REQUIRED	2-3;2-5
CR-4.1	Enter the ratings from CR-4.0 into the CR column of the master work-sheet, as shown in the righthand column of Figure CR-2.	
CR-5.0	Proceed with the second TRAINVICE II component, the Coverage (C) Analysis.	3-1 to 3-13

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS
1. Load the Launch Tube	CR
1.1 Lock traversing unit in azimuth and elevation	
1.1.1 Operate traversing unit	1
1.1.2 Azimuth and elevation movement	1
1.1.3 Locking mechanism	1
1.2 Remove encased missile from stowed position	
1.2.1 Remove casing materials from missile	0
1.2.2 Missile configuration	0
1.2.3 Casing materials	0
1.3 Load encased missile	
1.3.1 Loading procedure	1
1.3.2 Locking procedure	1
1.3.3 Safety aspects of launch tube preparation	1
1.3.4 Loading and locking mechanisms	1
2. Select a Target	
2.1 Visually select target	
2.1.1 Descrimination of enemy targets from other targets	0
2.1.2 Silhouettes of threat vehicles	0
2.1.3 Scanning techniques	1
2.2 Swing traversing unit to align optical sight	
2.2.1 Unlocking procedures	1
3. Connect Encased Missile	
3.1 Insure personnel are clear of firing danger zone	
3.1.1 Monitoring danger area	1
3.1.2 Danger zone area	1
3.2 Raise aiming lever	
3.2.1 Operating aiming lever	1
3.2.2 Position and function of aiming lever	1
4. Acquire and Track Target	
4.1 Turn on and adjust vehicle light if needed	
4.1.1 Operation of light switch	0
4.1.2 Light switch operating procedures	0
4.2 Operate focus control	
4.2.1 Perform focusing procedures	1
4.2.2 Locate focus control	1
4.2.3 Focusing control operation	1
4.3 Operate traversing sight	
4.3.1 Perform traversing movement	1
4.3.2 Traversing sight location	1
4.3.3 Traversing sight procedures	1
4.4 Operate optical sight	
4.4.1 Perform SOP for optical sighting	0
4.4.2 Optical sighting location	0
4.4.3 Optical sighting procedures	0
5. Launch Missile	
5.1 Lift trigger protective cover	
5.1.1 Unlock trigger protective cover	0
5.1.2 Trigger protective cover location	0
5.1.3 Unlocking procedures	0
5.2 Press firing trigger	
5.2.1 Perform firing procedures	1
5.2.2 Firing trigger location	1
5.2.3 Missile firing procedures	1
6. Track Target Until Missile Impact	
6.1 Make continuous adjustments to keep crosshairs centered on target	

FIGURE CR-2

TRAINVICE II Master Worksheet:

Consolidated List and Coverage Requirements Analysis



COVERAGE REQUIREMENTS ANALYSIS FLOWCHART

TRAINVICE II PROCEDURES CHECKLIST

"C"

COVERAGE ANALYSIS

- Purpose: To determine whether each device under evaluation provides for training each required skill/knowledge (i.e., those where CR=1).

> NOTE:
> A Coverage (C) Analysis must be conducted for <u>each</u> <u>device</u> being evaluated.

Procedures Checklist		Guidebook Reference
C-1.0	Select a skill/knowledge from the Consolidated List. Review the instructor's manual/design manual for the device being evaluated. Determine whether the device provides training for that skill/knowledge.	3-2;3-3
C-2.0	Rate whether or not the training device covers the first skill/knowledge, no matter how well or inadequately it does so. Use the following scale: 1 = PROVIDES TRAINING COVERAGE FOR THE SKILL/KNOWLEDGE 0 = DOES NOT PROVIDE TRAINING COVERAGE FOR THE SKILL/KNOWLEDGE	3-3;3-5

Procedures Checklist		Guidebook Reference
	C-2.1 Enter the rating from C-2.0 into the C column of the master worksheet, as shown in Figure C-1.	3-3;3-5
C-3.0	Select the next skill/knowledge. Repeat procedures C-1.0 through C-2.1 for the device being evaluated until all skill/ knowledges on the Consolidated List have received a C rating.	3-3;3-4
C-4.0	Repeat procedures C-1.0 through C-3.0 for each training device under consideration.	3-3;3-4
C-5.0	Proceed with the third TRAINVICE II component, the Training Proficiency (P) Analysis.	4-1 to 4-8

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS
1. Load the Launch Tube	CR	C	C
1.1 Lock traversing unit in azimuth and elevation			
1.1.1 Operate traversing unit	1	1	1
1.1.2 Azimuth and elevation equipment	1	1	1
1.1.3 Locking mechanism	1	1	1
1.2 Remove encased missile from stowed position			
1.2.1 Remove casing materials from missile	0	0	0
1.2.2 Missile configuration	0	0	0
1.2.3 Casing materials	0	0	0
1.3 Load encased missile			
1.3.1 Loading procedure	1	1	1
1.3.2 Locking procedure	1	1	1
1.3.3 Safety aspects of launch tube preparation	1	1	1
1.3.4 Loading and locking mechanisms	1	1	1
2. Select a Target			
2.1 Visually select target			
2.1.1 Descrimination of enemy targets from other targets	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0
2.1.3 Scanning techniques	1	1	1
2.2 Swing traversing unit to align optical sight			
2.2.1 Unlocking procedures	1	1	1
3. Connect Encased Missile			
3.1 Insure personnel are clear of firing danger zone			
3.1.1 Monitoring danger area	1	1	1
3.1.2 Danger zone area	1	1	1
3.2 Raise aiming lever			
3.2.1 Operating aiming lever	1	1	1
3.2.2 Position and function of aiming lever	1	1	1
4. Acquire and Track Target			
4.1 Turn on and adjust vehicle light if needed			
4.1.1 Operation of light switch	0	1	0
4.1.2 Light switch operating procedures	0	1	0
4.2 Operate focus control			
4.2.1 Perform focusing procedures	1	1	1
4.2.2 Locate focus control	1	1	1
4.2.3 Focusing control operation	1	1	1
4.3 Operate traversing sight			
4.3.1 Perform traversing movement	1	1	1
4.3.2 Traversing sight location	1	1	1
4.3.3 Traversing sight procedures	1	1	1
4.4 Operate optical sight			
4.4.1 Perform SOP for optical sighting	0	0	0
4.4.2 Optical sighting location	0	0	0
4.4.3 Optical sighting procedures	0	0	0
5. Launch Missile			
5.1 Lift trigger protective cover			
5.1.1 Unlock trigger protective cover	0	0	1
5.1.2 Trigger protective cover location	0	0	1
5.1.3 Unlocking procedures	0	0	0
5.2 Press firing trigger			
5.2.1 Perform firing procedures	1	1	1
5.2.2 Firing trigger location	1	1	1
5.2.3 Missile firing procedures	1	1	1
6. Track Target Until Missile Impact			
6.1 Make continuous adjustments to keep crosshairs centered on target			

Figure C-1

TRAINVICE II MASTER WORKSHEET

C Analysis for Two Training Devices

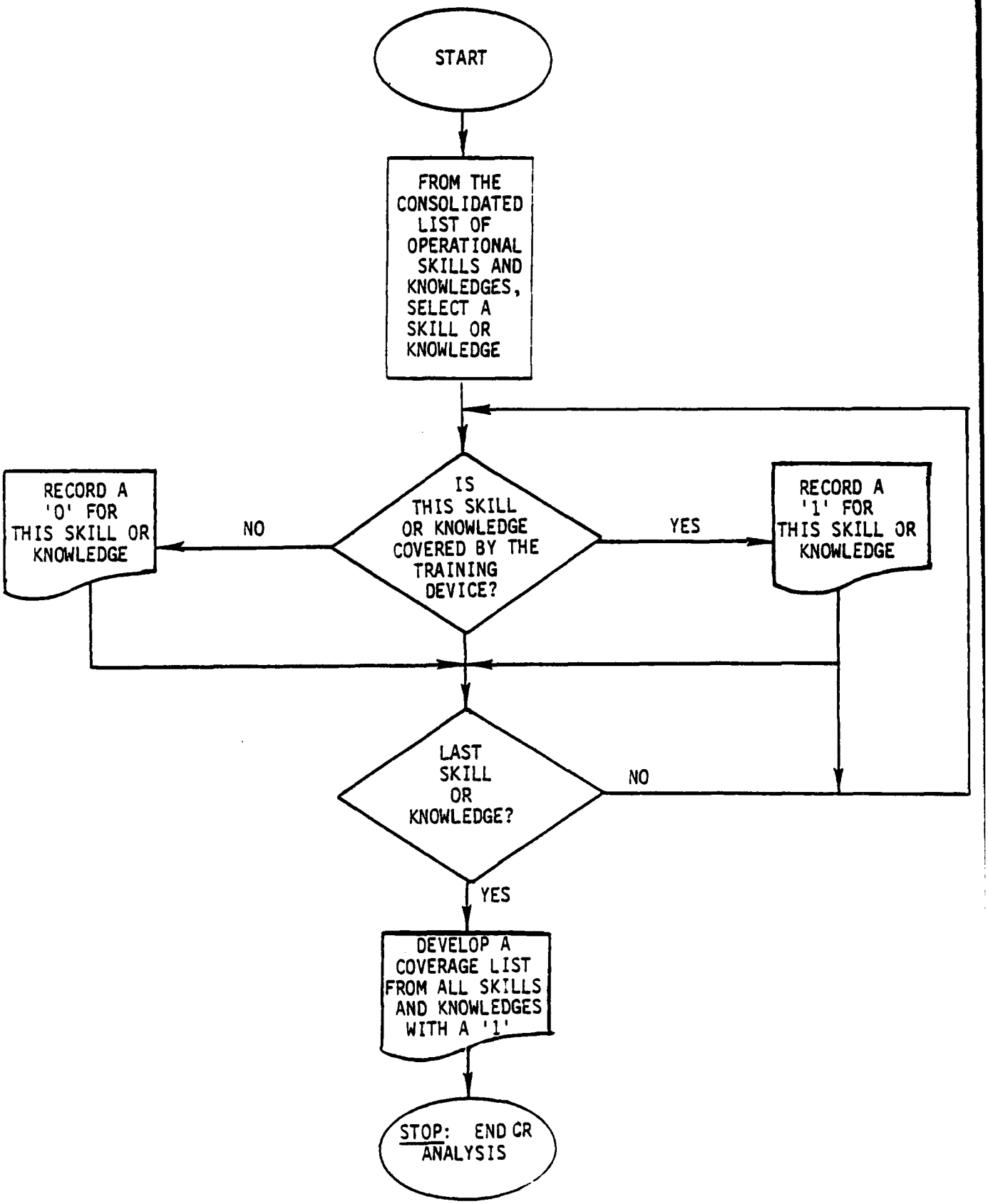


Figure 3-1

COVERAGE ANALYSIS FLOWCHART FOR USE WITH TRAINVICE II INDEX

TRAINVICE II PROCEDURES CHECKLIST

"P"

TRAINING PROFICIENCY ANALYSIS

- Purpose: To determine the degree of proficiency the the trainee must attain at the end o' training, for each required skill/kn edge.

NOTE:

(1) A Training Proficiency (P) Analysis is cc cted only <u>once</u> in TRAINVICE II. It is NOT conducted separately for each device under consideration.

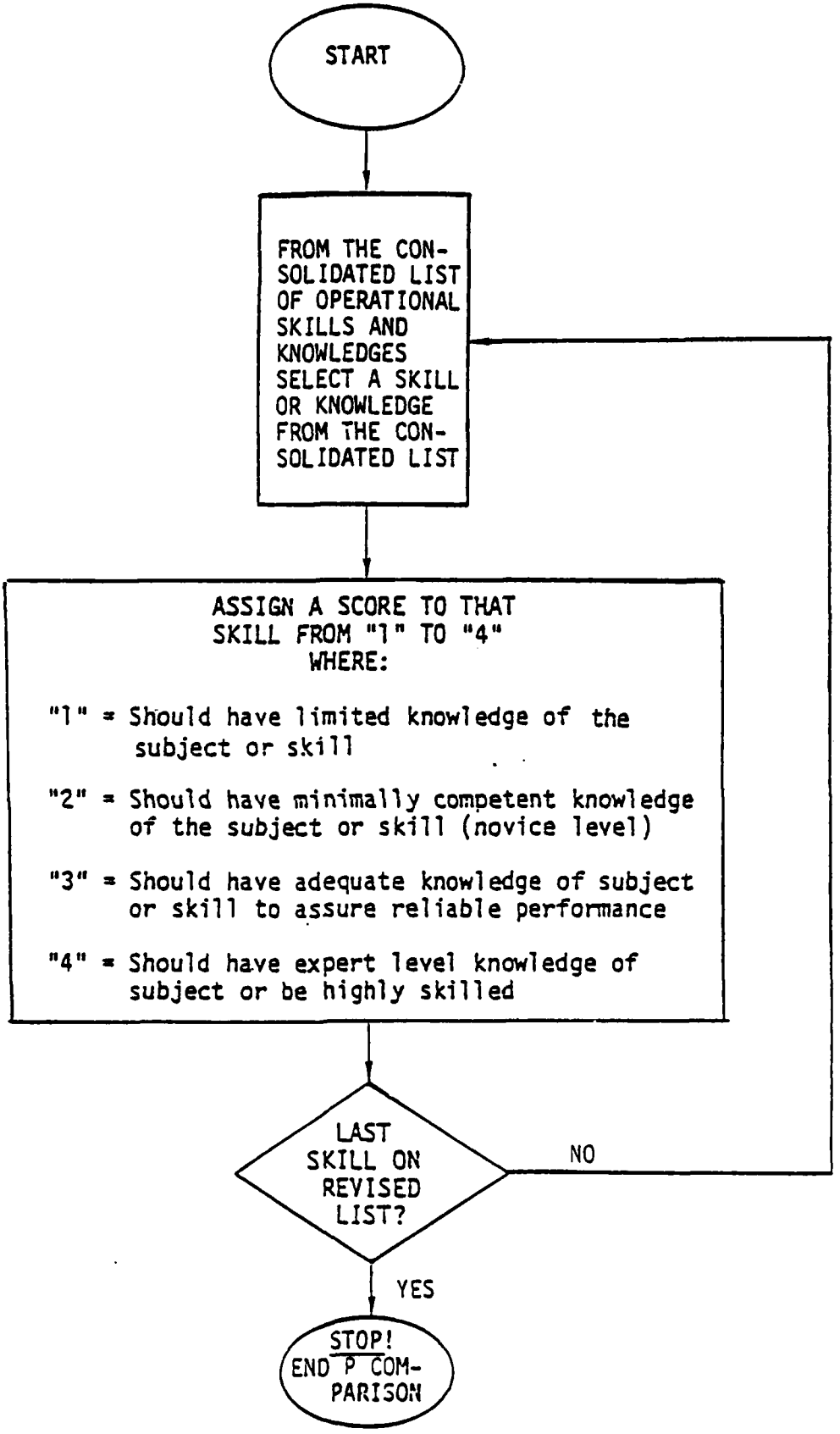
(2) A Training Proficiency (P) Analysis is conducted only for those skills/knowledges which received a CR rating of "1". All other skills/knowledges (those with a CR of "0") are assigned a zero score in the P Analysis.

Procedures Checklist		Guidebook Reference
P-1.0	Select a skill/knowledge from the Consolidated List. If the skill/knowledge received a CR rating of "0", assign it a P Analysis score of "0". If it received a CR rating of "1", judge what level of performance proficiency is required of the trainee at the end of training. To do this, use the following scale (see Guidebook Reference for complete scale definitions):	4-1;4-2;4-3; 4-4

Procedures Checklist		Guidebook Reference
	1 = SHOULD HAVE LIMITED KNOWLEDGE OF THE SUBJECT OR SKILL 2 = SHOULD HAVE MINIMALLY COMPETENT KNOWLEDGE OF THE SUBJECT OR SKILL (NOVICE LEVEL) 3 = SHOULD HAVE ADEQUATE KNOWLEDGE OF SUBJECT OR SKILL TO ASSURE RELIABLE PERFORMANCE 4 = SHOULD HAVE EXPERT LEVEL KNOWLEDGE OF SUBJECT OR BE HIGHLY SKILLED	
	P-1.1 Enter the rating from P-1.0 into the P column of the master worksheet, as shown in Figure P-1.	4-5
P-2.0	Select the next skill/knowledge. Repeat procedures P-1.0 and P-1.1 for that skill/knowledge until all skill/knowledges have been exhausted.	4-3;4-6
P-3.0	Proceed with the fourth TRAINVICE II component, the Learning Difficulty (D) Analysis.	5-1 to 5-9

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS
1. Load the Launch Tube	CR	C	C	P
1.1 Lock traversing unit in azimuth and elevation				
1.1.1 Operate traversing unit	1	1	1	3
1.1.2 Azimuth and elevation movement	1	1	1	3
1.1.3 Locking mechanism	1	1	1	3
1.2 Remove encased missile from stowed position				
1.2.1 Remove casing materials from missile	0	0	0	0
1.2.2 Missile configuration	0	0	0	0
1.2.3 Casing materials	0	0	0	0
1.3 Load encased missile				
1.3.1 Loading procedure	1	1	1	4
1.3.2 Locking procedure	1	1	1	4
1.3.3 Safety aspects of launch tube preparation	1	1	1	4
1.3.4 Loading and locking mechanisms	1	1	1	4
2. Select a Target				
2.1 Visually select target				
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4
2.2 Swing traversing unit to align optical sight				
2.2.1 Unlocking procedures	1	1	1	4
3. Connect Encased Missile				
3.1 Insure personnel are clear of firing danger zone				
3.1.1 Monitoring danger area	1	1	1	3
3.1.2 Danger zone area	1	1	1	3
3.2 Raise aiming lever				
3.2.1 Operating aiming lever	1	1	1	3
3.2.2 Position and function of aiming lever	1	1	1	3
4. Acquire and Track Target				
4.1 Turn on and adjust vehicle light if needed				
4.1.1 Operation of light switch	0	1	0	0
4.1.2 Light switch operating procedures	0	1	0	0
4.2 Operate focus control				
4.2.1 Perform focusing procedures	1	1	1	3
4.2.2 Locate focus control	1	1	1	3
4.2.3 Focusing control operation	1	1	1	3
4.3 Operate traversing sight				
4.3.1 Perform traversing movement	1	1	1	3
4.3.2 Traversing sight location	1	1	1	3
4.3.3 Traversing sight procedures	1	1	1	3
4.4 Operate optical sight				
4.4.1 Perform SOP for optical sighting	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0
5. Launch Missile				
5.1 Lift trigger protective cover				
5.1.1 Unlock trigger protective cover	0	0	1	0
5.1.2 Trigger protective cover location	0	0	1	0
5.1.3 Unlocking procedures	0	0	0	0
5.2 Press firing trigger				
5.2.1 Perform firing procedures	1	1	1	4
5.2.2 Firing trigger location	1	1	1	4
5.2.3 Missile firing procedures	1	1	1	4
6. Track Target Until Missile Impact				
6.1 Make continuous adjustments to keep crosshairs centered on target				

FIGURE P-1 TRAINVICE II MASTER WORKSHEET
TRAINING PROFICIENCY ANALYSIS COLUMN ADDED



Training Proficiency Analysis Flowchart

TRAINVICE II PROCEDURES CHECKLIST

"D"

LEARNING DIFFICULTY ANALYSIS

- Purpose: To determine the degree of difficulty associated with learning each required skill/knowledge.

NOTE:

(1) A Learning Difficulty (D) Analysis is conducted only <u>once</u> in TRAINVICE II. It is not conducted separately for each device under consideration.

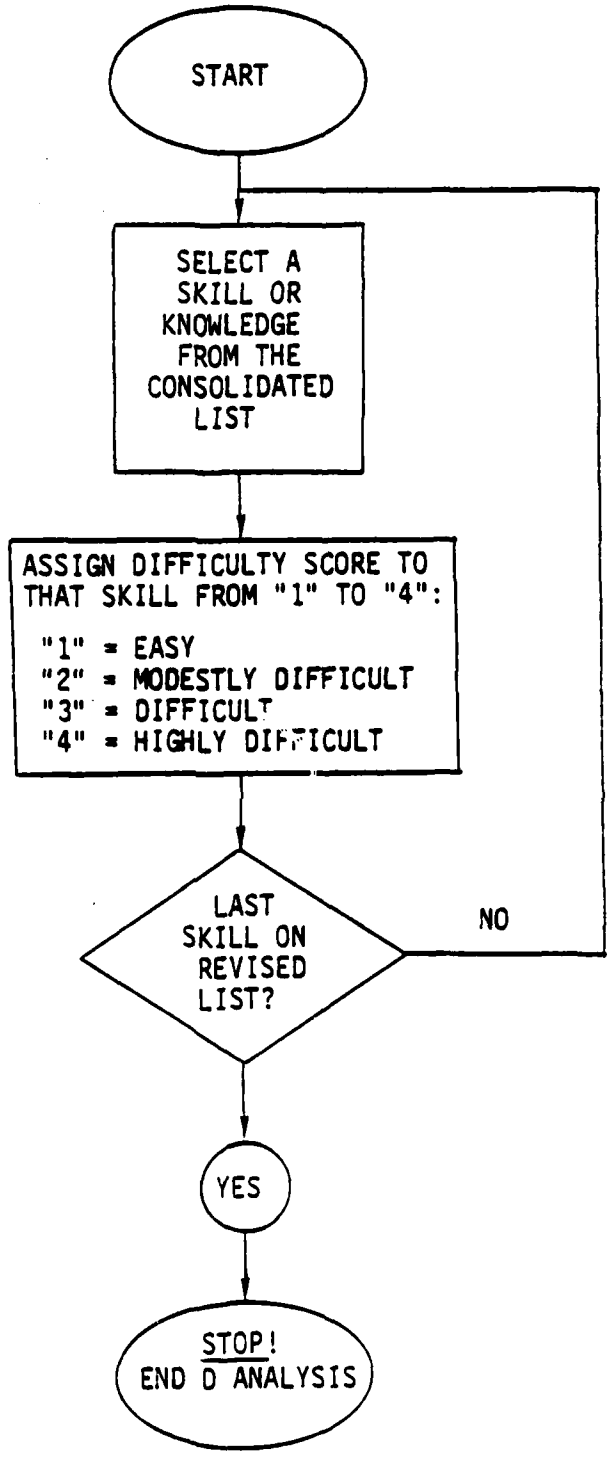
(2) A Learning Difficulty (D) Analysis is conducted only for those skills/knowledges which received a CR rating of "1". All other skills/knowledges (those with a CR of "0") are assigned a zero score in the D Analysis.

Procedures Checklist		Guidebook Reference
D-1.0	Select a skill/knowledge from the Consolidated List. If the skill/knowledge received a CR rating of "0", assign it a D Analysis score of "0". If it received a CR rating of "1", judge what level of learning difficulty it requires of the trainees. To do this, use the following scale (see Guidebook Reference for complete scale definitions): 1 = EASY 2 = MODESTLY DIFFICULT 3 = DIFFICULT 4 = HIGHLY DIFFICULT	5-2;5-3

Procedures Checklist		Guidebook Reference
	D-1.1 Enter the rating from D-1.0 into the D column of the master worksheet, as shown in Figure D-1.	5-5
D-2.0	Select the next skill/knowledge. Repeat procedures D-1.0 and D-1.1 for that skill/ knowledge until all skills/knowledges have been exhausted.	5-3
D-3.0	Proceed with the fifth TRAINVICE II component, the Physical Characteristics (PC) Analysis	6-1 to 6-35

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS
1. Load the Launch Tube	CR	C	C	P	D
1.1 Lock traversing unit in azimuth and elevation					
1.1.1 Operate traversing unit	1	1	1	3	3
1.1.2 Azimuth and elevation movement	1	1	1	3	3
1.1.3 Locking mechanism	1	1	1	3	3
1.2 Remove encased missile from stowed position					
1.2.1 Remove casing materials from missile	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0
1.3 Load encased missile					
1.3.1 Loading procedure	1	1	1	4	2
1.3.2 Locking procedure	1	1	1	4	2
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2
1.3.4 Loading and locking mechanisms	1	1	1	4	2
2. Select a Target					
2.1 Visually select target					
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2
2.2 Swing traversing unit to align optical sight					
2.2.1 Unlocking procedures	1	1	1	4	3
3. Connect Encased Missile					
3.1 Insure personnel are clear of firing danger zone					
3.1.1 Monitoring danger area	1	1	1	3	2
3.1.2 Danger zone area	1	1	1	3	2
3.2 Raise aiming lever					
3.2.1 Operating aiming lever	1	1	1	3	3
3.2.2 Position and function of aiming lever	1	1	1	3	3
4. Acquire and Track Target					
4.1 Turn on and adjust vehicle light if needed					
4.1.1 Operation of light switch	0	1	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3
4.2 Operate focus control					
4.2.1 Perform focusing procedures	1	1	1	3	2
4.2.2 Locate focus control	1	1	1	3	1
4.2.3 Focusing control operation	1	1	1	3	1
4.3 Operate traversing sight					
4.3.1 Perform traversing movement	1	1	1	3	2
4.3.2 Traversing sight location	1	1	1	3	1
4.3.3 Traversing sight procedures	1	1	1	3	1
4.4 Operate optical sight					
4.4.1 Perform SOP for optical sighting	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0
5. Launch Missile					
5.1 Lift trigger protective cover					
5.1.1 Unlock trigger protective cover	0	0	1	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0
5.1.3 Unlocking procedures	0	0	0	0	0
5.2 Press firing trigger					
5.2.1 Perform firing procedures	1	1	1	4	3
5.2.2 Firing trigger location	1	1	1	4	3
5.2.3 Missile firing procedures	1	1	1	4	3
6. Track Target Until Missile Impact					
6.1 Make continuous adjustments to keep crosshairs centered on target					

FIGURE D-1 TRAINVICE II MASTER WORKSHEET
DIFFICULTY ANALYSIS COLUMN ADDED



LEARNING DIFFICULTY ANALYSIS FLOW CHART

TRAINVICE II PROCEDURES CHECKLIST

"PC"

PHYSICAL CHARACTERISTICS ANALYSIS

- Purpose: To assess the physical characteristics of a training device's instructional delivery system.

NOTE:
A Physical Characteristic (PC) Analysis is conducted for each device under consideration.

Procedures Checklist	Guidebook Reference
PC-1.0 Select a skill or knowledge from the Consolidated List. Write the skill or knowledge in the first column of your analyst-made PC Analysis Worksheet (Figure PC-1) for the device being evaluated.	6-2;6-5;6-6; 6-7;6-8
PC-2.0 Compare each required skill/knowledge to the ten behavioral categories given in APPENDIX A. Then decide which of those categories best describes "learning" for the particular skill or knowledge you are considering.	6-3;6-8;6-9
Write the behavioral category you select in Column II of the PC Worksheet, beside the skill/knowledge to which it bess applies (Figure PC-1).	6-12
PC-3.0 For the Required skill/knowledge, locate its behavioral category in APPENDIX B.	6-11;6-12

I	II	III	IV	V	VI	VII	
SKILL/KNOWLEDGE	BEHAVORAL CATEGORY	LEARNING GUIDE-LINES FOR GOOD INSTRUCTIONAL PRACTIVE	DISPLAY/CONTROL	APPLICABLE GENERIC CHARACTERISTICS	GENERAL CHARACTERISTICS	RATING	PHYSICAL CHARACTER-ISTICS SCORE $\frac{\text{SUM OF RATINGS}}{\text{PC}_{max}}$
1.1.1 Operate Traversing Unit	Performs gross motor skills	1, 2, 3, 4, 7, 10, 11, 12, 13, 14, 15	Device Traversing Subsystem	• STIMULUS CAPABILITY (1) Visual form, 1.5 (2) Visual movement, 2.3 (3) Visual spectrum, 3.3 (4) Scale, 4.1 (6) Tactile-Kinaesthetic, 6.2	• STIMULUS 1. Visual form 2. Visual movement 3. Visual spectrum 4. Scale 5. (Audio = N/A) 6. Tactile-Kinesthetic	 3 3 3 3 - 3	18/18
				• TRAINEE RESPONSE MODE (8) Broad movement manipulative acts	• TRAINEE RESPONSE MODE	3	
1.1.2 Azimuth & Elevation Movement	Classifying - Recognizing Patterns	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12	Optical Sight	• STIMULUS CAPABILITY	• STIMULUS 1. Visual form 2. Visual movement 3. Visual spectrum 4. Scale 5. (Audio = N/A) 6. (Tactile-Kinesthetic = N/A)	 3 3 3 3 - -	15/15
				• TRAINEE RESPONSE MODE	• TRAINEE RESPONSE MODE	3	
1.1.3 Locking Mechanism	Positioning Movement and recalling procedures	3, 4, 8, 11, 14, 16, 17, 18, 22, 23 25	Device Traversing Locking Mechanism	• STIMULUS CAPABILITY	• STIMULUS 1. Visual form 2. Visual movement 3. Visual spectrum 4. Scale 5. (Audio = N/A) 6. (Tactile-Kinesthetic = N/A)	 3 3 3 3 - -	15/15
				• TRAINEE RESPONSE MODE	• TRAINEE RESPONSE MODE	3	

FIGURE PC-1 PHYSICAL CHARACTERISTICS ANALYSIS WORKSHEET
(CALCULATED FOR THE "SHERMAN" SIMULATOR)

Procedures Checklist		Guidebook Reference
PC-3.1	Under the behavioral category in APPENDIX B, study the learning guidelines associated with physical characteristics (P or P/F). Select those learning guidelines appropriate to the device you are analyzing (most should apply).	6-3;6-12;6-1
PC-3.2	In Column II of the PC Worksheet, record the learning guidelines you selected beside their corresponding skill/knowledge (use abbreviated statements or numeric codes).	6-15
PC-4.0	Determine what displays or controls are used by the training device in training the required skill/knowledge.	6-16;6-17
	Enter a description of these displays or controls in Column IV of your PC Analysis Worksheet.	6-18
PC-5.0	For each display/control identified in Step PC-4.0, use the information in Figure PC-2 to define its: (1) generic stimulus characteristics (2) corresponding trainee response mode Record these in column V of the PC Analysis Worksheet.	6-20;6-21;6-2 6-23;6-25

STIMULUS CAPABILITIES [1]

(1) VISUAL FORM

1.1 Visual Alphanumeric - words, numbers and other symbols presented graphically.

1.2 Visual Pictorial, Plane - a two-dimensional image, a representation in the form of a photograph or drawing.

1.3 Visual Line Construction, Plane - a two-dimensional figure made of lines, such as a mathematical curve or graph.

1.4 Visual Object, Solid - a three-dimensional image or reality that is viewed from exterior perspectives.

1.5 Visual Environment - A three-dimensional image or reality that is viewed from inside.

(2) VISUAL MOVEMENT

2.1 Visual Still - a static visual field, as with a still photograph, drawing, or printed page.

2.2 Visual Limited Movement - a basically static visual field with elements that can be made to move, as with an animated transparency or simple panel with switches that move.

2.3 Visual Full Movement - a visual field in which all elements can move, as with a motion picture, flight simulator, or operational aircraft.

2.4 Visual Cyclic Movement - a visual field which moves through a fixed sequence and then repeats the sequence in a repetitive manner, as with a film loop.

(3) VISUAL SPECTRUM

3.1 Black and White - a visual field composed of either black or white elements, as with the printed page or line drawings.

3.2 Gray Scale - a visual field composed of black, white and continuous gradations of gray, as with a black and white photograph or television picture.

3.3 Color - a visual field composed of various segments of the visual spectrum, as with color television or motion pictures.

(4) SCALE

4.1 Exact Scale - actual visual field or a one-to-one replication of that field as with a full-sized mock-up, simulator, or operational system.

4.2 Proportional Scale - a representation of reality in other than full scale, such as a scaled model map or photograph.

(5) AUDIO

5.1 Voice Sound Range - a limited quality of sound which enables spoken words to be used as the medium of communications, but not suited to more demanding tasks, such as music or sound recognition exercises.

5.2 Full Sound Range - a quality of sound reproduction that contains all the significant elements of the sound and is suited to the demanding task of sound recognition exercises.

5.3 Ambient Sounds - a complex sound environment with sounds emanating from various sources and from various directions, including background noise and task significant sounds.

(6) TACTILE-KINESTHETIC

6.1 Tactile Cues - signals received through the sense of touch, inlcuding sensations related to texture, size or shape.

6.2 Internal Stimulus Motion Cues - the sensations felt by a person when he moves his arm, leg, fingers, etc.

6.3 External Stimulus Motion Cues - the sensations felt by a person whe he is moved by some outside force in such a way that his body experiences roll, pitch, yaw, heave, sway and/or surge.

TRAINEE RESPONSE MODE [2]

(1) Covert Response - a response which the trainee creates in his mind but does not express in an obserbable manner.

(2) Multiple Choice - a response mode in which a trainee selects a response from a limited set of responses.

(3) Pre-programmed Verbal Performance - a response mode in which a trainee creates a short answer to a question having a limited set of correct answeres.

(4) Free-Style Written Performance - a response mode in which a trainee writes a response in his own words.

(5) Decision Indicator - a verbal or perceptual motor response in which the trainee indicates that he has made a divergent type decision.

(6) Voice Performance - a response mode in which a trainee speaks, including conversation.

(7) Fine Movement Manipulative Acts - a response mode in which a trainee makes discrete and small movements of dials, switches, keys or makes sensitive adjustments to insturments. Act may involve use of small instruments.

(8) Broad Movement Manipulative Acts - a response mode in which a trainee makes large movements of levers or wheels on large pieces of equipment or by the use of equipment or by the use of hand held tools.

(9) Tracking - a response mode in which a trainee continuously controls a constantly changing system, such as steering an automobile or holding a compass bearing in steering a ship.

(10) Procedural Manipulative Acts - a response mode in which a trainee performs the sequence of steps in a procedure, such as in the carrying out of the items on the checklist for pre-flighting an aircraft or turning on a radar system.

[1] From just a few to many of these capabilities may apply to the device/control being characterized.

[2] Only one type of response will be made by the trainee to the corresponding stimulus.

FIGURE PC-2

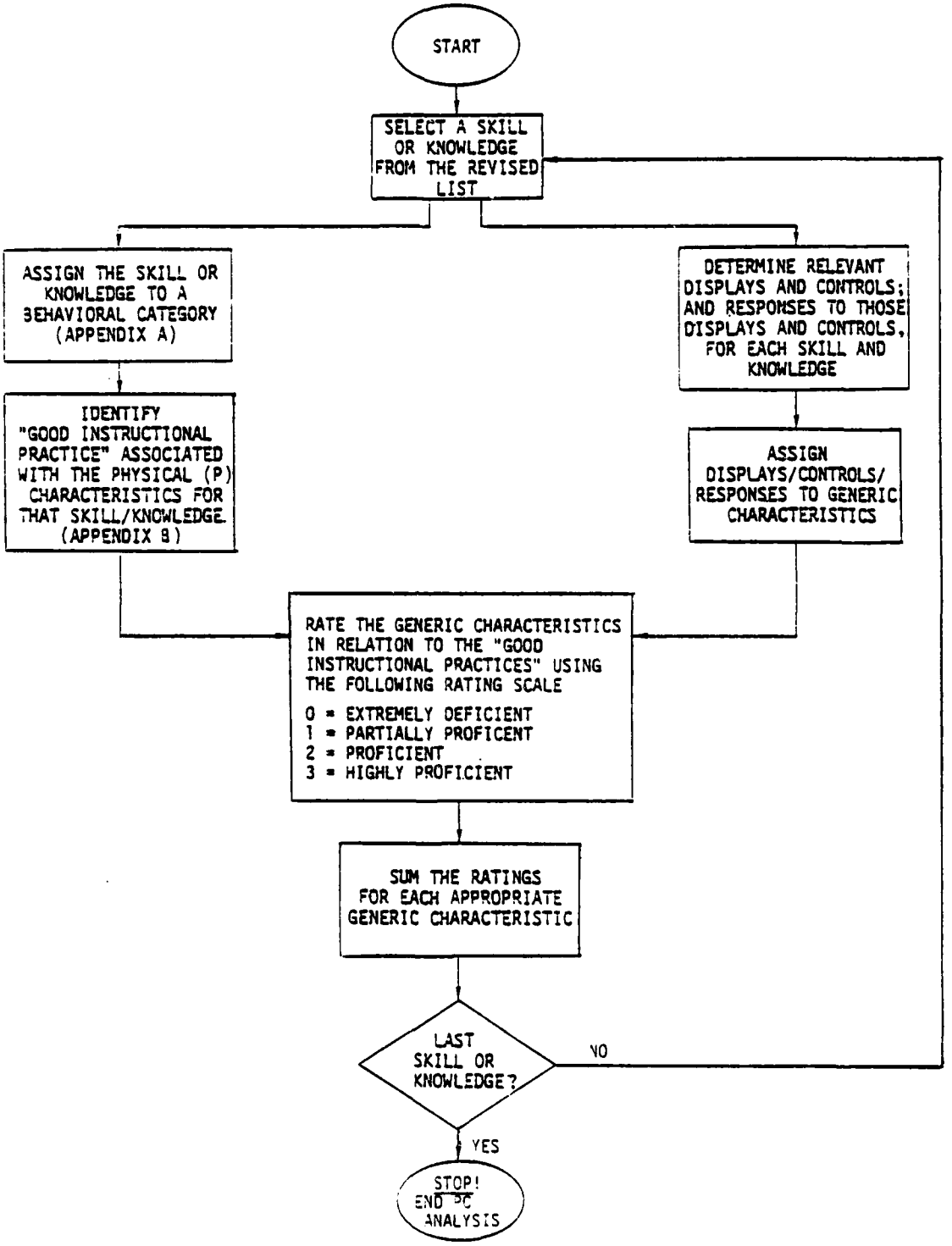
GENERIC STIMULUS CHARACTERISTICS AND CORRESPONDING TRAINEE RESPONSE MODES

Procedures Checklist		Guidebook Reference
	REMEMBER: IF THE SKILL/KNOWLEDGE IS COVERED BY THE DEVICE (C = 1), THEN: • AT LEAST ONE GENERIC STIMULUS CHARACTERISTIC MUST BE SELECTED. • A RESPONSE MODE MUST BE SELECTED.	6-27;6-30
PC-6.0	For each skill/knowledge, rate how well each generic characteristic of the device's displays/controls supports the set of instructional guidelines associated with the skill/knowledge. To do this, use the following rating scale (see Guidebook Reference for complete scale definitions): 0 = EXTREMELY DEFICIENT 1 = PARTIALLY PROFICIENT 2 = PROFICIENT 3 = HIGHLY PROFICIENT Be sure to rate each generic characteristic (Figure PC-1 Column VI) as to how well it implements its companion set of good instructional practices (Column III).	6-27;6-28;6-2
PC-7.0	Sum the ratings from Column VI and enter then in Column VII.	6-30

Procedures Checklist	Guidebook Reference
PC-7.1 Calculate and record each PC_{max} score for its corresponding PC Score:	6-30
PC_{max} = No. of applicable generic characteristics X Highest possible rating value, which is always "3"	6-31
PC-8.0 Go back to step PC-1.0 of the PC Analysis and repeat the entire process for the next skill, until your Consolidated List is exhausted. Record all scores for the device on the TRAINVICE II Master Worksheet (Figure PC-3).	6-31;6-33
PC-9.0 Repeat procedures PC-1.0 through PC-8.0 for the next training device, until all training devices have been evaluated.	6-33
PC-10 Proceed with the sixth TRAINVICE II component, the Functional Characteristics (FC) Analysis.	7-1 to 7-21

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS	SHERMAN PHYSICAL CHARACTERISTIC SCORE	PATTON PHYSICAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE PC SCORE	PATTON MAXIMUM POSSIBLE PC SCORE
1. Load the Launch Tube	CR	C	C	P	D	PC	PC	PC_{max}	PC_{max}
1.1 Lock traversing unit in azimuth and elevation									
1.1.1 Operate traversing unit	1	1	1	3	3	18	18	18	18
1.1.2 Azimuth and elevation movement	1	1	1	3	3	15	15	15	15
1.1.3 Locking mechanism	1	1	1	3	3	15	15	15	15
1.2 Remove encased missile from stowed position									
1.2.1 Remove casing materials from missile	0	0	0	0	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0	0	0	0	0
1.3 Load encased missile									
1.3.1 Loading procedure	1	1	1	4	2	18	18	18	18
1.3.2 Locking procedure	1	1	1	4	2	18	18	18	18
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2	18	18	18	18
1.3.4 Loading and locking mechanisms	1	1	1	4	2	18	18	18	18
2. Select a Target									
2.1 Visually select target									
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2	13	21	21	21
2.2 Swing traversing unit to align optical sight									
2.2.1 Unlocking procedures	1	1	1	4	3	18	18	18	18
3. Connect Encased Missile									
3.1 Insure personnel are clear of firing danger zone									
3.1.1 Monitoring danger area	1	1	1	3	2	15	0	15	15
3.1.2 Danger zone area	1	1	1	3	2	15	0	15	15
3.2 Raise aiming lever									
3.2.1 Operating aiming lever	1	1	1	3	3	18	18	18	18
3.2.2 Position and function of aiming lever	1	1	1	3	3	18	18	18	18
4. Acquire and Track Target									
4.1 Turn on and adjust vehicle light if needed									
4.1.1 Operation of light switch	0	1	0	0	0	0	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3	0	0	0	0
4.2 Operate focus control									
4.2.1 Perform focusing procedures	1	1	1	3	2	18	18	18	18
4.2.2 Locate focus control	1	1	1	3	1	18	18	18	18
4.2.3 Focusing control operation	1	1	1	3	1	18	18	18	18
4.3 Operate traversing sight									
4.3.1 Perform traversing movement	1	1	1	3	2	18	18	18	18
4.3.2 Traversing sight location	1	1	1	3	1	18	18	18	18
4.3.3 Traversing sight procedures	1	1	1	3	1	18	18	18	18
4.4 Operate optical sight									
4.4.1 Perform SOP for optical sighting	0	0	0	0	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0	0	0	0	0
5. Launch Missile									
5.1 Lift trigger protective cover									
5.1.1 Unlock trigger protective cover	0	0	1	0	0	0	0	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0	0	0	0	0
5.1.3 Unlocking procedures	0	0	0	0	0	0	0	0	0
5.2 Press firing trigger									
5.2.1 Perform firing procedures	1	1	1	4	3	21	18	21	21
5.2.2 Firing trigger location	1	1	1	4	3	21	18	21	21
5.2.3 Missile firing procedures	1	1	1	4	3	21	15	21	21
6. Track Target Until Missile Impact									
6.1 Make continuous adjustments to keep crosshairs centered on target									

FIGURE PC-3 TRAINVICE II Worksheet:
SHOWING PC and PC_{max} SCORES FOR
SHERMAN AND PATTON



PHYSICAL CHARACTERISTICS ANALYSIS FLOWCHART

TRAINVICE II PROCEDURES CHECKLIST

"FC"

FUNCTIONAL CHARACTERISTICS ANALYSIS

- Purpose: To assess the physical characteristics of a training device's instructional delivery system.

NOTE:

1) A Functional Characteristics (FC) Analysis is conducted for each device under consideration.
2) Do not attempt to conduct this analysis until you have familiarized yourself with the PC Analysis. The FC Analysis is an extension of PC Analysis procedures.

Procedures Checklist	Guidebook Reference
FC-1.0 Select a skill/knowledge from the Consolidated List. For the skill/knowledge, locate its behavioral category in APPENDIX B (as determined from the PC Analysis)	7-2;7-7;7-9
FC-1.1 Under the behavioral category located in APPENDIX B, study the learning guidelines for "good instructional practice" associated with functional characteristics (F or P/F). Select those learning guidelines appropriate to the type of device you are analyzing (most should apply).	7-2;7-3;7-7;7-8
FC-1.2 In Column VIII of the FC Worksheet (Figure FC-1) record the learning guidelines you selected beside the skill/knowledge to which they correspond (use abbreviated statements or numeric codes).	7-6;7-8;7-9;7-10; 7-12

I	II	IV		VIII	IX	X
SKILL/KNOWLEDGE	BEHAVIORAL CATEGORY	DISPLAY/CONTROL		APPLICABLE FUNCTIONAL GUIDELINES	RATING	FUNCTIONAL CHARACTERISTIC SCORE OVER FC_{max}
1.1.1 Operate Traversing Unit	Performs gross motor skills	Device Traversing Subsystem		3. Prevent knowledge 4. Present cues 7. Penalty follows 10. Learner demonstrate 11. Provide specific practice 12. Provide varied practice 13. Make objective evident 14. Provide rest 15. Provide distractions 16. Make objective clear 17. Relate learning to tasks 18. Provide feedback 19. Feed comparisons 20. Allow rest 23. Require overlearning 24. Allow individual differences	2 0 0 3 3 3 1 3 2 3 3 0 0 3 2 1	29/48
(From PC ANALYSIS)				FC ANALYSIS		

FIGURE FC-1

FUNCTIONAL CHARACTERISTICS ANALYSIS WORKSHEET

AND

RELEVANT COLUMNS FROM THE PC ANALYSIS WORKSHEET

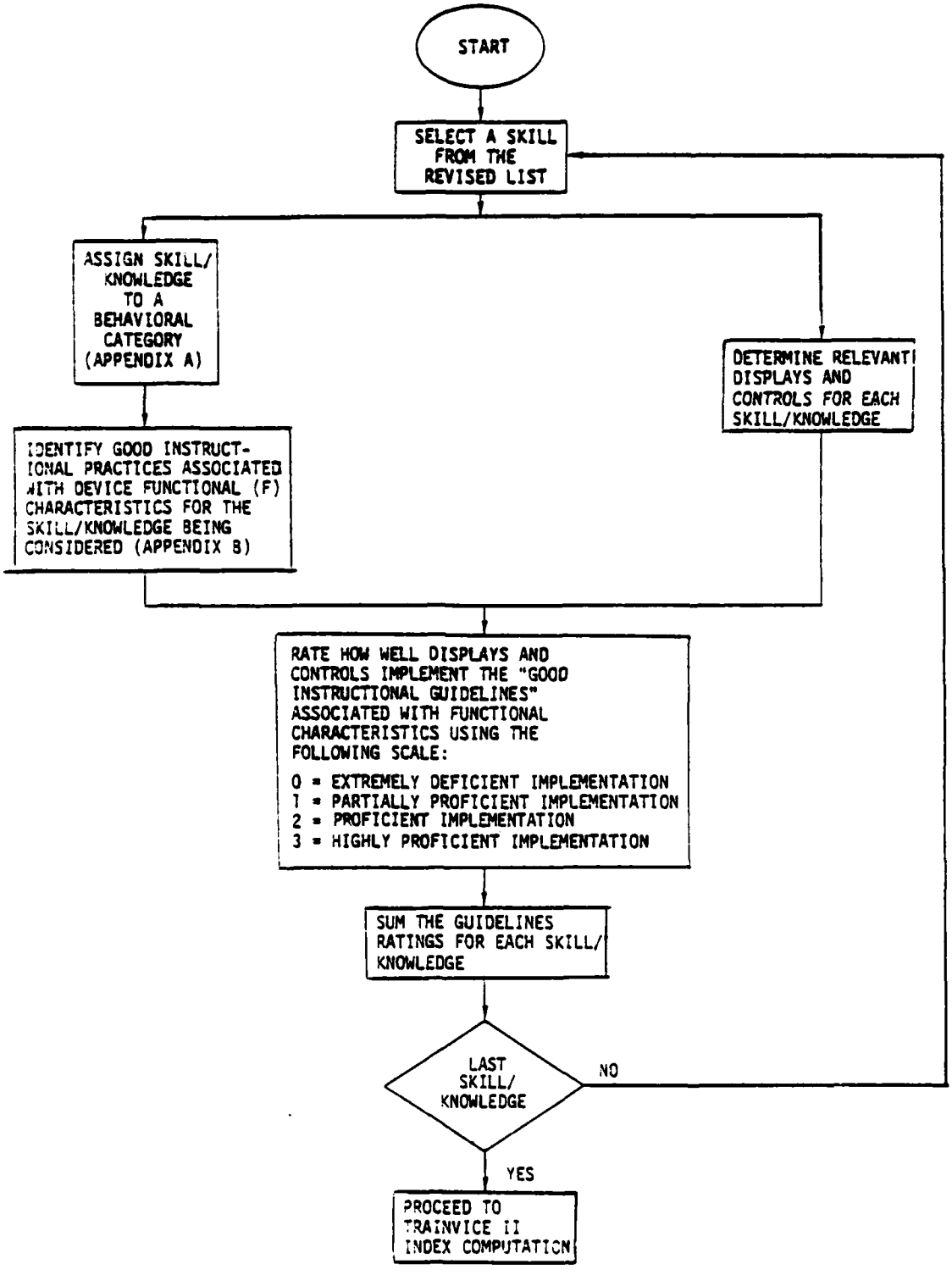
(Calculated for SHERMAN simulator)

Procedures Checklist	Guidebook Reference
FC-2.0 Rate the display or control (found in Figure FC-1, Column IV) as to how well it implements its companion set of good instructional practices (Column VIII) associated with the skill/knowledge. To do this, use the following rating scale (see Guidebook Reference for complete scale definitions): 0 - EXTREMELY DEFICIENT 1 = PARTIALLY PROFICIENT 2 = PROFICIENT 3 = HIGH PROFICIENT FC-2.1 Enter these ratings in Column IX, beside the corresponding instructional practice guideline to which they apply. FC-2.2 CALCULATE AND RECORD EACH FC_{max} SCORE FOR ITS CORRESPONDING FC SCORE:	7-14;7-15
FC_{max} = The total number of Applicable Functional Guidelines in Column VIII X The highest possible rating which is always "3"	7-17
FC-3.0 Sum the ratings in Column IX and enter the sum in Column X as a ratio of the POINTS EARNED/POINTS POSSIBLE.	7-16
FC-4.0 Go back to Step FC-1.0 of the FC Analysis and repeat the entire procedure for the next skill/knowledge, until your consolidated list is exhausted. Record all data on the TRAINVICE II Master Worksheet (Fig. FC-2).	7-16;7-17

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS	SHERMAN PHYSICAL CHARACTERISTIC SCORE	PATTON PHYSICAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE PC SCORE	PATTON MAXIMUM POSSIBLE PC SCORE	SHERMAN FUNCTIONAL CHARACTERISTIC SCORE	PATTON FUNCTIONAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE FC SCORE	PATTON MAXIMUM POSSIBLE FC SCORE
1. Load the Launch Tube	CR	C	C	P	D	PC	PC	PC_{max}	PC_{max}	FC	FC	FC_{max}	FC_{max}
1.1 Lock traversing unit in azimuth and elevation													
1.1.1 Operate traversing unit	1	1	1	3	3	18	18	18	18	29	13	48	15
1.1.2 Azimuth and elevation movement	1	1	1	3	3	15	15	15	15	14	15	15	15
1.1.3 Locking mechanism	1	1	1	3	3	15	15	15	15	15	14	18	15
1.2 Remove encased missile from stowed position													
1.2.1 Remove casing materials from missile	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3 Load encased missile													
1.3.1 Loading procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.2 Locking procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.4 Loading and locking mechanisms	1	1	1	4	2	18	18	18	18	15	15	15	15
2. Select a Target													
2.1 Visually select target													
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2	13	21	21	21	12	18	18	18
2.2 Swing traversing unit to align optical sight													
2.2.1 Unlocking procedures	1	1	1	4	3	18	18	18	18	15	15	18	18
3. Connect Encased Missile													
3.1 Insure personnel are clear of firing danger zone													
3.1.1 Monitoring danger area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.1.2 Danger zone area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.2 Raise aiming lever													
3.2.1 Operating aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
3.2.2 Position and function of aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
4. Acquire and Track Target													
4.1 Turn on and adjust vehicle light if needed													
4.1.1 Operation of light switch	0	1	0	0	0	0	0	0	0	0	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3	0	0	0	0	0	0	0	0
4.2 Operate focus control													
4.2.1 Perform focusing procedures	1	1	1	3	2	18	18	18	18	15	15	15	15
4.2.2 Locate focus control	1	1	1	3	1	18	18	18	18	15	15	15	15
4.2.3 Focusing control operation	1	1	1	3	1	18	18	18	18	15	15	15	15
4.3 Operate traversing sight													
4.3.1 Perform traversing movement	1	1	1	3	2	18	18	18	18	18	18	18	18
4.3.2 Traversing sight location	1	1	1	3	1	18	18	18	18	18	18	18	18
4.3.3 Traversing sight procedures	1	1	1	3	1	18	18	18	18	18	18	18	18
4.4 Operate optical sight													
4.4.1 Perform SOP for optical sighting	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Launch Missile													
5.1 Lift trigger protective cover													
5.1.1 Unlock trigger protective cover	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.3 Unlocking procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5.2 Press firing trigger													
5.2.1 Perform firing procedures	1	1	1	4	3	21	18	21	21	24	18	24	21
5.2.2 Firing trigger location	1	1	1	4	3	21	18	21	21	24	18	24	24
5.2.3 Missile firing procedures	1	1	1	4	3	21	15	21	21	24	15	24	24
6. Track Target Until Missile Impact													
6.1 Make continuous adjustments to keep crosshairs centered on target													

FIGURE FC-2 COMPLETED TRAINVICE II MASTER WORKSHEET

Procedures Checklist	Guidebook Reference
FC-5.0 Repeat procedures FC-1.0 through FC-4.0 for the next training device, until all training devices have been evaluated.	7-20
FC-6.0 Proceed with TRAINVICE II INDEX (TI) calculation	8-1 to 8-17



FUNCTIONAL CHARACTERISTICS ANALYSIS FLOWCHART

TRAINVICE II PROCEDURES CHECKLIST

"TI"

TRAINVICE II INDEX

- Purpose: To calculate the final score (TRAINVICE II INDEX-or-"TI") for <u>each</u> training device evaluated.

Procedures Checklist	Guidebook Reference
TI-1.0 Select a skill/knowledge from the completed TRAINVICE II master worksheet (a sample worksheet is shown completed in Figure TI-1). If the skill/knowledge was assigned a CR rating of "0", discard it.	8-5
NOTE: Skill/knowledges with CR=0 are not entered into TI computations.	
If the skill/knowledge has a CR rating of "1", retain it for TI computation.	
TI-2.0 From the Master Worksheet, enter the C, P, D, PC, FC, PCmax, and FCmax scores of the skill/knowledge into the TI (skill) equation given in Figure TI-2.	8-6
TI-2.1 Record the TI (skill) equation (with values substituted) for the particular skill/knowledge on a master computation sheet for the device. Two examples of master computation sheets as provided as Figures TI-3 and TI-4.	8-6;8-9;8-10; 8-11;8-12

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	SHERMAN COVERAGE ANALYSIS	PATTON COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS	SHERMAN PHYSICAL CHARACTERISTIC SCORE	PATTON PHYSICAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE PC SCORE	PATTON MAXIMUM POSSIBLE PC SCORE	SHERMAN FUNCTIONAL CHARACTERISTIC SCORE	PATTON FUNCTIONAL CHARACTERISTIC SCORE	SHERMAN MAXIMUM POSSIBLE FC SCORE	PATTON MAXIMUM POSSIBLE FC SCORE
1. Load the Launch Tube	CR	C	C	P	B	PC	PC	PC_{max}	PC_{max}	FC	FC	FC_{max}	FC_{max}
1.1 Lock traversing unit in azimuth and elevation													
1.1.1 Operate traversing unit	1	1	1	3	3	18	18	18	18	29	13	48	15
1.1.2 Azimuth and elevation movement	1	1	1	3	3	15	15	15	15	14	15	15	15
1.1.3 Locking mechanism	1	1	1	3	3	15	15	15	15	16	14	18	15
1.2 Remove encased missile from stowed position													
1.2.1 Remove casing materials from missile	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.2 Missile configuration	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2.3 Casing materials	0	0	0	0	0	0	0	0	0	0	0	0	0.
1.3 Load encased missile													
1.3.1 Loading procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.2 Locking procedure	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.3 Safety aspects of launch tube preparation	1	1	1	4	2	18	18	18	18	15	15	15	15
1.3.4 Loading and locking mechanisms	1	1	1	4	2	18	18	18	18	15	15	15	15
2. Select a Target													
2.1 Visually select target													
2.1.1 Descrimination of enemy targets from other targets	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.2 Silhouettes of threat vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1.3 Scanning techniques	1	1	1	4	2	13	21	21	21	12	18	18	18
2.2 Swing traversing unit to align optical sight													
2.2.1 Unlocking procedures	1	1	1	4	3	18	18	18	18	15	15	18	18
3. Connect Encased Missile													
3.1 Insure personnel are clear of firing danger zone													
3.1.1 Monitoring danger area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.1.2 Danger zone area	1	1	1	3	2	15	0	15	15	15	0	15	15
3.2 Raise aiming lever													
3.2.1 Operating aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
3.2.2 Position and function of aiming lever	1	1	1	3	3	18	18	18	18	18	18	21	21
4. Acquire and Track Target													
4.1 Turn on and adjust vehicle light if needed													
4.1.1 Operation of light switch	0	1	0	0	0	0	0	0	0	0	0	0	0
4.1.2 Light switch operating procedures	0	1	0	0	3	0	0	0	0	0	0	0	0
4.2 Operate focus control													
4.2.1 Perform focusing procedures	1	1	1	3	2	18	18	18	18	15	15	15	15
4.2.2 Locate focus control	1	1	1	3	1	18	18	18	18	15	15	15	15
4.2.3 Focusing control operation	1	1	1	3	1	18	18	18	18	15	15	15	15
4.3 Operate traversing sight													
4.3.1 Perform traversing movement	1	1	1	3	2	18	18	18	18	18	18	18	18
4.3.2 Traversing sight location	1	1	1	3	1	18	18	18	18	18	18	18	18
4.3.3 Traversing sight procedures	1	1	1	3	1	18	18	18	18	18	18	18	18
4.4 Operate optical sight													
4.4.1 Perform SOP for optical sighting	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.2 Optical sighting location	0	0	0	0	0	0	0	0	0	0	0	0	0
4.4.3 Optical sighting procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Launch Missile													
5.1 Lift trigger protective cover													
5.1.1 Unlock trigger protective cover	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.2 Trigger protective cover location	0	0	1	0	0	0	0	0	0	0	0	0	0
5.1.3 Unlocking procedures	0	0	0	0	0	0	0	0	0	0	0	0	0
5.2 Press firing trigger													
5.2.1 Perform firing procedures	1	1	1	4	3	21	18	21	21	24	18	24	21
5.2.2 Firing trigger location	1	1	1	4	3	21	18	21	21	24	18	24	24
5.2.3 Missile firing procedures	1	1	1	4	3	21	15	21	21	24	15	24	24
6. Track Target Until Missile Impact													
6.1 Make continuous adjustments to keep crosshairs centered on target													

• To derive the TRAINVICE II INDEX for a single/skill knowledge (TI_{skill}), following equation is used:

$$TI_{(skill)} = \frac{\left(\frac{PC + FC}{PC_{max} + FC_{max}}\right)(C \times P \times D)}{(P \times D)}$$

WHERE:

PC = Physical Characteristics score

FC = Functional Characteristics score

PC_{max} = Maximum possible Physical Characteristics score

FC_{max} = Maximum possible Functional Characteristics score

C = Coverage Analysis score

P = Proficiency score

D = Difficulty score

FIGURE TI-2

$TI_{(skill)}$ COMPUTATION

SKILL	TI		CUMULATIVE TI
1.1.1	$\frac{\left(\frac{18+29}{18+48}\right)(1\times3\times3)}{3\times3}$	$= \frac{6.41}{9}$	$\frac{6.41}{9}$
1.1.2	$\frac{\left(\frac{15+14}{15+15}\right)(1\times3\times3)}{3\times3}$	$= \frac{8.70}{9}$	$\frac{15.11}{18}$
1.1.3	$\frac{\left(\frac{15+15}{15+18}\right)(1\times3\times4)}{3\times3}$	$= \frac{10.91}{9}$	$\frac{26.02}{27}$
1.3.1	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{34.02}{35}$
1.3.2	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{42.02}{43}$
1.3.3	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{50.02}{51}$
1.3.4	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{58.02}{59}$
2.1.3	$\frac{\left(\frac{13+12}{21+18}\right)(1\times4\times2)}{4\times2}$	$= \frac{5.13}{8}$	$\frac{63.15}{67}$
2.2.1	$\frac{\left(\frac{18+15}{18+18}\right)(1\times4\times3)}{4\times3}$	$= \frac{11.00}{12}$	$\frac{74.15}{79}$
3.1.1	$\frac{\left(\frac{15+15}{15+15}\right)(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{80.15}{85}$
3.1.2	$\frac{\left(\frac{15+15}{15+15}\right)(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{86.15}{91}$
3.2.1	$\frac{\left(\frac{18+18}{18+21}\right)(1\times3\times3)}{3\times3}$	$= \frac{8.31}{9}$	$\frac{94.46}{100}$
3.2.2	$\frac{\left(\frac{18+18}{18+21}\right)(1\times3\times3)}{3\times3}$	$= \frac{8.31}{9}$	$\frac{102.77}{109}$
4.2.1	$\frac{\left(\frac{18+15}{18+15}\right)(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{108.77}{115}$
4.2.2	$\frac{\left(\frac{18+15}{18+15}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{111.77}{118}$
4.2.3	$\frac{\left(\frac{18+15}{18+15}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{114.77}{121}$
4.3.1	$\frac{\left(\frac{18+18}{18+18}\right)(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{120.77}{127}$
4.3.2	$\frac{\left(\frac{18+18}{18+18}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{123.77}{130}$
4.3.3	$\frac{\left(\frac{18+18}{18+18}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{126.77}{133}$
5.2.1	$\frac{\left(\frac{21+24}{21+24}\right)(1\times4\times3)}{4\times3}$	$= \frac{12}{12}$	$\frac{138.77}{145}$
5.2.2	$\frac{\left(\frac{21+24}{21+24}\right)(1\times4\times3)}{4\times3}$	$= \frac{12}{12}$	$\frac{150.77}{157}$
5.2.3	$\frac{\left(\frac{21+24}{21+24}\right)(1\times4\times3)}{4\times3}$	$= \frac{12}{12}$	$\frac{162.77}{169} = .963$

THEREFORE

$$\frac{\sum\left(\frac{PC+FC}{PC_{max}+FC_{max}}\right)\left(C\times C_1\times D\right)}{\sum\left(C_1\times D\right)} = .963 = .96$$

TABLE TI-3 TI COMPUTATION FOR SHERMAN

SKILL	TI		CUMULATIVE TI
1.1.1	$\frac{\left(\frac{18+13}{18+15}\right)(1\times3\times3)}{3\times3}$	$= \frac{8.46}{9}$	$\frac{8.46}{9}$
1.1.2	$\frac{\left(\frac{15+15}{15+15}\right)(1\times3\times3)}{3\times3}$	$= \frac{9}{9}$	$\frac{17.46}{18}$
1.1.3	$\frac{\left(\frac{15+14}{15+15}\right)(1\times3\times3)}{3\times3}$	$= \frac{8.7}{9}$	$\frac{26.16}{27}$
1.3.1	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{34.16}{35}$
1.3.2	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{42.16}{43}$
1.3.3	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{50.16}{51}$
1.3.4	$\frac{\left(\frac{18+15}{18+15}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{58.16}{59}$
2.1.3	$\frac{\left(\frac{21+18}{21+18}\right)(1\times4\times2)}{4\times2}$	$= \frac{8}{8}$	$\frac{66.16}{67}$
2.2.1	$\frac{\left(\frac{18+15}{18+18}\right)(1\times4\times3)}{4\times3}$	$= \frac{11}{12}$	$\frac{77.16}{79}$
3.1.1	$\frac{\left(\frac{0+0}{15+15}\right)(1\times3\times2)}{3\times2}$	$= \frac{0}{6}$	$\frac{77.16}{85}$
3.1.2	$\frac{\left(\frac{0+0}{15+15}\right)(1\times3\times2)}{3\times2}$	$= \frac{0}{6}$	$\frac{77.16}{91}$
3.2.1	$\frac{\left(\frac{18+18}{18+21}\right)(1\times3\times3)}{3\times3}$	$= \frac{8.31}{9}$	$\frac{85.47}{100}$
3.2.2	$\frac{\left(\frac{18+18}{18+21}\right)(1\times3\times3)}{3\times2}$	$= \frac{8.31}{9}$	$\frac{93.78}{109}$
4.2.1	$\frac{\left(\frac{18+15}{18+15}\right)(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{99.78}{115}$
4.2.2	$\frac{\left(\frac{18+15}{18+15}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{102.78}{118}$
4.2.3	$\frac{\left(\frac{18+15}{18+15}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{105.78}{121}$
4.3.1	$\frac{\left(\frac{18+18}{18+18}\right)(1\times3\times2)}{3\times2}$	$= \frac{6}{6}$	$\frac{111.78}{127}$
4.3.2	$\frac{\left(\frac{18+18}{18+18}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{114.78}{130}$
4.3.3	$\frac{\left(\frac{18+18}{18+18}\right)(1\times3\times1)}{3\times1}$	$= \frac{3}{3}$	$\frac{117.78}{133}$
5.2.1	$\frac{\left(\frac{18+18}{21+21}\right)(1\times4\times3)}{4\times3}$	$= \frac{10.29}{12}$	$\frac{128.07}{145}$
5.2.2	$\frac{\left(\frac{18+18}{21+24}\right)(1\times4\times3)}{4\times3}$	$= \frac{9.6}{12}$	$\frac{137.67}{157}$
5.2.3	$\frac{\left(\frac{15+15}{21+24}\right)(1\times4\times3)}{4\times3}$	$= \frac{8.0}{12}$	$\frac{145.67}{169} = .864$

THEREFORE

$$\frac{\Sigma\left(\frac{PC + FC}{PC_{max} + FC_{max}}\right)(C \times C_1 \times D)}{\Sigma\left(C_1 \times D\right)} = .864 = .86$$

TABLE TI-4 TI COMPUTATION FOR PATTON

Procedures Checklist	Guidebook Reference
TI-3.0 Repeat procedures TI-1.0 through TI-2.1 for each skill/knowledge until the Consolidated List is exhausted for the particular device's scores.	8-12
TI-4.0 Repeat procedures TI-1.0 through TI-3.0 until the TI (skill) equations for all devices being considered have been recorded on their own master computation sheets.	8-12;8-14;8-15
TI-5.0 Compute the cumulative (final) TI (formula) given in Figure TI-5). Calculation examples are provided in Figures TI-3 and TI-4.	8-15;8-16

NOTE:

To calculate the final TRAINVICE II INDEX (TI), first sum all $TI_{(skill)}$ values in the upper portion of the equation independently; then sum all lower portions of the equation. A "common denominator", therefore is NOT employed. The final TI can thus be expressed as:

$$TI_{(final)} = \frac{\sum(TI_{skill}\ \text{Upper Part})}{\sum(TI_{skill}\ \text{Lower Part})}$$

TI-6.0 STOP! The TRAINVICE II analysis is complete once the final TI has been calculated for each device.

TRAINVICE II INDEX CALCULATION

To calculate the final TRAINVICE II INDEX (TI), the formula in the following equation is used:

$$TI = \frac{\sum\left(\frac{PC + FC}{PC_{max} + FC_{max}}\right)\left(C \times P \times D\right)}{\sum\left(P \times D\right)}$$

WHERE:

TI = TRAINVICE II INDEX (final score) for the particular training device being analyzed

$\sum$ = Sum of (accumulation)

PC = Physical Characteristics score

FC = Functional Characteristics score

PC_{max} = Maximum possible Physical Characteristics score

FC_{max} = Maximum possible Functional Characteristics score

C = Coverage Analysis score

P = Proficiency score

D = Difficulty score

FIGURE TI-5

TRAINVICE II INDEX

APPENDIX E

TRAINVICE II WORKSHEETS

TASKS AND SUBTASKS (with appropriate skills and knowledges)	COVERAGE REQUIREMENTS ANALYSIS	DEVICE I COVERAGE ANALYSIS	DEVICE II COVERAGE ANALYSIS	TRAINING PROFICIENCY ANALYSIS	LEARNING DIFFICULTY ANALYSIS	DEVICE I PHYSICAL CHARACTERISTIC SCORE	DEVICE II PHYSICAL CHARACTERISTIC SCORE	DEVICE I MAXIMUM POSSIBLE PC SCORE	DEVICE II MAXIMUM POSSIBLE PC SCORE	DEVICE I FUNCTIONAL CHARACTERISTIC SCORE	DEVICE II FUNCTIONAL CHARACTERISTIC SCORE	DEVICE I MAXIMUM POSSIBLE FC SCORE	DEVICE II MAXIMUM POSSIBLE FC SCORE

TRAINVICE II MASTER WORKSHEET

I	II	III	IV	V	VI		VII	VIII	IX	X
SKILL/KNOWLEDGE	BEHAVIORAL CATEGORY	LEARNING GUIDELINES FOR GOOD INSTRUCTIONAL PRACTICE	DISPLAY/CONTROL	APPLICABLE GENERIC CHARACTERISTICS	GENERAL CHARACTERISTICS	RATING	PHYSICAL CHARACTERISTICS SCORE $\frac{\text{SUM OF RATINGS}}{PC_{max}}$	APPLICABLE FUNCTIONAL GUIDELINES	RATINGS	FUNCTIONAL CHARACTERISTICS SCORE OVER FC_{max}

TRAINVICE II:
PHYSICAL CHARACTERISTICS - FUNCTIONAL CHARACTERISTICS
ANALYST WORKSHEET